SOCIETY OF AMERICAN FORESTERS 1900

Journal of FORESTRY

July 1960
Volume 58
Number 7

INDIAN

FIRE PUMP OF 1960!

This year's **INDIAN FIRE PUMPS** are streamlined beauties — built right, designed properly and ready to go to work for **YOU** the day they are received. Read what this user says:

"You will be pleased to know that all of our woods fires fire-fighting pumps are **INDIANS.** I have used and recommended your knapsack pump over a long period of time and I can say unhesitatingly that it is **THE BEST I HAVE EVER KNOWN.**"

C. H. Schaeffer, Chief, Florida Board of Parks, Tallahassee, Florida

No. 90 INDIAN Fire Pump

(sliding pump type)

No. 80 INDIAN Fire Pump

(lever type pump and handle)

BOTH MODELS APPROVED BY FACTORY MUTUAL

INDIAN FIRE PUMPS have no equal for quickly and easily putting out grass, brush, forest, rubbish, roof, room and other fires . . . using only clear water . . . **no chemicals.**

Send for new catalog describing both models of **INDIAN FIRE PUMPS** and containing many testimonials.

Send for folder describing NEW FIBERGLASS No. 90 INDIAN FIRE PUMP. Light weight. Will not rust or corrode.

Send for NEW Catalog

D. B. SMITH & CO. "FOR SEVENTY YEARS THE LEADERS" **407 Main St., Utica 2, N.Y.**

Pacific Coast Branches:

Hercules Equipment & Rubber Co., Inc. San Francisco 7, Calif. San Jose, Calif.
Halprin Supply Co. Los Angeles 15, Calif.
Fred E. Barnett Co. Portland, Ore.
Fred E. Barnett Co. Klamath, Ore.
Mill & Mine Supply Inc. Seattle 4, Wash.
L. M. Curtis & Sons Salt Lake City, Utah

Canadian Agents:
Fleck Bros. Ltd. Vancouver, B. C., Canada
C. E. Hickey & Sons, Ltd. Hamilton, Canada

VOLUME 58
NUMBER 7

Journal of Forestry

JULY 1960

EDITORIAL STAFF

ARTHUR B. MEYER ..... *Editor*
HENRY CLEPPER ..... *Managing Editor*
L. AUDREY WARREN ..... *Business Manager*

Associate Editors

JAMES S. BETHEL, *Forest and Wood Utilization*, National Science Foundation, Washington, D. C.

C. ALLEN BICKFORD, *Mensuration*, Northeastern Forest Experiment Station 102 Motors Avenue, Upper Darby, Pa.

ROBERT L. FURNISS, *Forest Pathology and Entomology*, Pacific Northwest Forest and Range Experiment Station, P. O. Box 4059, Portland, Ore.

OTIS F. HALL, *Forest Management and Engineering*, Department of Forestry and Conservation, Purdue University, Lafayette, Ind.

LEE M. JAMES, *Forest Economics and Policy*, Department of Forestry, Michigan State University, East Lansing, Mich.

ROBERT D. MCCULLEY, *Silviculture*, Division of FM Research, Lake States Forest Experiment Station, 300 Green Hall, St. Paul Campus, University of Minnesota, St. Paul 1, Minn.

LANSING A. PARKER, *Forest-Wildlife Management and Recreation*, Bureau of Sport Fisheries and Wildlife, U. S. Department of the Interior, Washington 25, D. C.

SCOTT S. PAULEY, *Forest Genetics and Artificial Regeneration*, School of Forestry, University of Minnesota, St. Paul 1, Minn.

CHARLES E. POULTON, *Range Management*, Range Management W-302, Oregon State College, Corvallis, Ore.

WILLIAM E. REIFSNYDER,, *Forest Fire*, School of Forestry, Yale University, New Haven 11, Conn.

SIDNEY WEITZMAN, *Watershed Management*, Lake States Forest Experiment Station, 300 Green Hall, St. Paul Campus, University of Minnesota, St. Paul 1, Minn.

LLOYD THORPE, *Advertising Representative*, 766 Dexter Horton Building, Seattle 4, Wash.

The JOURNAL OF FORESTRY, established in 1917, is the official organ of the Society of American Foresters, but the Society assumes no responsibility for the statements and opinions expressed by contributors.

Publication office, 425 Mills Building, 17th Street at Pennsylvania Avenue N. W., Washington 6, D. C. Address all correspondence concerning editorial or business matters to JOURNAL OF FORESTRY, 425 Mills Building, 17th Street at Pennsylvania Avenue N. W., Washington 6, D. C. Published monthly. Subscription $9.00 per year; single copies $1.00. Missing numbers will be replaced without charge provided claim is made within thirty days after date of the following issue.

The editors are not responsible for loss or damage of manuscripts and photographs while in transit or in their possession. All material submitted for publication should be accompanied by return postage.

Copyright, 1960, by the Society of American Foresters. Second class postage paid at Washington, D. C. and at additional mailing offices.

CONTENTS

COVER: Fikany Lake, Cottonwood Pass, San Isabel National Forest, Colorado.

Photo U. S. Forest Service by Bluford W. Muir

How Good Are Statistics on Fire Causes? Craig C. Chandler 515

Deer Browsing and Douglas-Fir Seedling Growth in Northwestern California D. F. Roy 518

The Effect of Biocides on the Survival of Mycorrhizal Fungi D. J. Persidsky and S. A. Wilde 522

Forestry in the U. S. Virgin Islands Robert W. Nobles 524

Effects of Desiccation on Puddled Versus Bare-Rooted Loblolly Pine (Pinus taeda L.) and Longleaf Pine (P. palustris Mill.) Planting Stock G. K. Slocum and T. E. Maki 528

Computing Growth from Increment Cores with Point Sampling Albert R. Stage 531

Girard Form Class Estimation from Lower Bole Measurements on Upland White Oak Trees in Missouri Jack D. Harris and Andrew J. Nash 534

A Study of Consumer Preference in Christmas Trees D. P. Duncan, E. T. Sullivan, C. J. Shiue, and R. I. Beazley 537

A Cone Production Study in Loblolly Pine on The Coastal Plain of North Carolina Eyvind Thorbjornsen 543

Site Index of Ponderosa Pine in the Black Hills from Soil and Topography Clifford A. Myers and James L. Van Deusen 548

Watersheds A and B—A Study of Surface Runoff and Erosion in the Subalpine Zone of Central Utah Richard O. Meeuwig 556

Notes and Observations 561

Points of View 567

Book Reviews 569

Current Literature 571

Society Affairs 572

Forestry News 585

Index to Advertisers 592

PANAMA

For efficient and economical spot marking of trees we offer the PANAMA Pressure Type Tree Marking Gun.

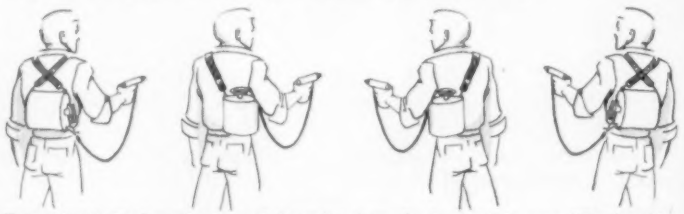
This Gun designed and engineered in close co-operation with Forestry men for speed; convenience; economy and long trouble-free life—

The Tank is made of heavy gauge welded steel—Each Unit subjected to hydrostatic test of 100 lbs.—

Large Capacity Air Pump enables operator to build pressure up quickly with little effort Nozzles with smaller openings available for numbering and lettering of trees—

Paint flow is restricted at the nozzle which cleans itself each time the trigger is operated—Constant pressure in tank enables operator to spot mark trees *WITHOUT DRIBBLING PAINT*—

The saving in paint used should, in a very short time, more than overcome the cost of the gun—Built-in Wrenches for hose couplings and fittings—Suitable for all types of Tree Marking Paint—Simplicity of design provides for complete dis-assembly and easy cleaning—



Tank equipped with 4 carrying lugs and 2 carrying straps—Can be carried in many different positions none of which requires that the weight of the paint is in the operator's hand. Hand piece can be hung onto the operator's belt to free both hands for Tallying etc.

CAPACITY
Up to 1 Gal. Sufficient to spot mark 500 or more trees without refilling.

PRICES
MILD STEEL TANK $26.50
STAINLESS STEEL TANK $33.00

WEIGHT
Packed for shipment, 8 lbs.

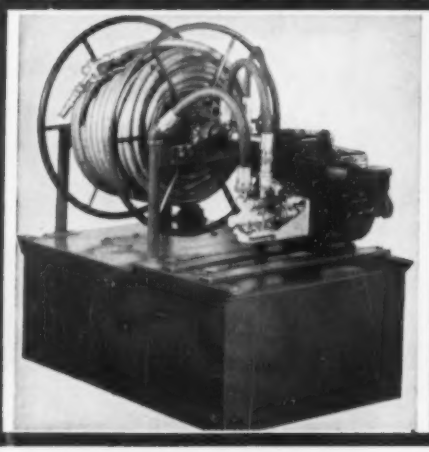
PANAMA PUMP CO.
Hattiesburg, Miss.

FORESTER
FOREST FIRE EQUIPMENT (Trade Mark)

FIRE FIGHTING OUTFITS

YOUR OWN FIRE "ENGINE," INSTANTLY AT YOUR COMMAND FOR FAST INITIAL ATTACK.

U. S. FOREST SERVICE STANDARD FOR PATROL CARS, 50 GAL. CAP.
(Larger Sizes Available)



This Hard Hitting "One-Man" Outfit Is Adequate For Complete Control When Fires Are Still Small, Also To "Hold" Larger Fires Until Help Arrives.

SIMPLE, RELIABLE, ECONOMICAL

MOUNT IT IN YOUR ½ TON PICKUP IN 15 MINUTES
Leaves ample space and load capacity for "working gear." Ideal for Foresters, Loggers, Patrolmen, Tree Farmers, Ranchers, Construction Bosses and similar field service, during fire season.

Developed in co-operation with the U. S. Forest Service to withstand constant rugged field service, without overloading vehicles. Designed for simplicity in operation and reliable performance. Made of best materials and first class workmanship. Larger sizes 100-500 gallon capacity available.

SEND FOR DESCRIPTIVE BULLETIN

WESTERN FIRE EQUIPMENT CO.
Manufacturers of Forest Fire Equipment
69 MAIN STREET, SAN FRANCISCO 5, U.S.A. *Branch: Portland, Ore.*

Journal of Forestry

Official Organ of the Society of American Foresters

How Good Are Statistics on Fire Causes?

Craig C. Chandler

STATISTICS on fire causes obtained from individual fire reports (Form 929) form the backbone of most of the fire-control and fire-prevention planning in the U. S. Forest Service. Although many of our plans are only as good as the statistics on which they are based, the question of statistical reliability was considered academic until the Tennessee Valley Authority published an eye-opening report in 1954.[1] The authors of this report found after careful investigation of 238 fires in two Tennessee counties, that only 9 percent of the fires were of incendiary origin, although nearly 60 percent were listed as incendiary on the official field reports. These findings not only shook the faith of many fire control men in their only source of planning data, but caused a major revision in prevention emphasis throughout the region.

Study of Causes

In 1956 the Pacific Southwest Experiment Station and the California Region of the Forest Service began a series of studies aimed at (1) determining the relative risk of fire from different causal agencies and (2) rating the effectiveness of various prevention programs. Much of the early work in these studies was based on analyses of individual fire reports, and the question of the reliability of these data was urgent. Since we had neither the time nor the money to undertake complete and independent investigations of fires, we used a questionnaire system similar to that used successfully in Canada for obtaining fire-prevention information.[2]

Three national forests representing the northern, central, and southern zones of the state were supplied with questionnaire forms and instruction sheets. The forms were to be filled out by the investigating officer on every fire of the preceding fire season and currently for each fire in 1956. In each case the investigating officer was to analyze his basis for deciding the general cause of the fire, the specific cause, class of people responsible, and whether local or outsider. Each decision was placed in one of four categories as follows:

1. *Positive*: Cause established by confession, statement of reliable witness, or physical evidence. This category is intended to cover cases where fire cause is established beyond doubt and which would be admissible in court of law. Physical evidence includes such things as fresh lightning scars and evidences of campfires where the pattern of burned area clearly shows that the fire spread from the campfire.

2. *Reasonably certain*: Cause established by strong circumstantial evidence. This category covers cases where fire cause is virtually certain but which might not stand up in court. For example; if a fire were to be discovered spreading from a spot near a stream where fishermen are known to smoke, and if a man carrying a fishing rod was seen leaving the area 15 minutes before the fire was discovered, and if no one else was known to have been near the area, the cause would be listed in this category.

3. *Most probable*: Cause established by weak circumstantial evidence or by process of elimination between two possibilities. If a fire were discovered in the same location as in the previous example, but if no one was seen in the area before the fire was discovered, the general cause (smoker) would be listed in this category. The class of people responsible (fisherman) would be listed in this category *only* if there were no more than two probable alternatives. If the

THE AUTHOR is on the staff of the Pacific Southwest Forest and Range Expt. Sta., Forest Service, U. S. Department of Agriculture, Berkeley, Calif.

[1]Tennessee Valley Authority. How forest fires get started in Cumberland and Morgan Counties, Tennessee. Tenn. Div. of Forest, Nashville, and TVA, Div. of Forestry Relations, Norris, Tenn. 10 pp. 1954.

[2]Doyle, J. A. A survey of forest fire causes and suggested corrective measures. Forestry Chron. 27(12):335-348. 1951.

TABLE 1.—PROBABLE ACCURACY OF GENERAL CAUSE ESTIMATES

General cause	Number of fires in category 1	2	3	4	Total	Average accuracy
Lightning	79	1	0	0	80	1.00
Railroad	0	2	0	0	2	0.90
Lumbering	10	2	1	0	13	0.95
Campfire	15	3	2	1	21	0.91
Smoker	7	15	30	10	62	0.63
Debris burning	11	3	1	1	16	0.91
Incendiary	4	1	3	0	8	0.80
Miscellaneous	22	9	5	0	36	0.91
All man-caused fires	69	35	42	12	158	0.79

fire might have been started by either fishermen, itinerants, or children playing with matches, the causal agent would be listed in category 4.

4. *Best estimate*: Cause established by process of elimination from several possibilities or by general knowledge of the situation. This category includes all cases which cannot be listed in categories 1, 2, or 3.

When questionnaries were received from the field the information was punched on key-sort cards together with other data on the fire obtained from the individual fire report. The decision categories were assigned accuracy values of 1.00 for positive, 0.90 for reasonably certain, 0.50 for most probable, and 0.33 for best estimate. Then average probability values were determined for each general cause.

Results

These probability values (Table 1) made several points immediately apparent. First, there is virtually no possibility of man-caused fires being listed as lightning-caused. Second, the average accuracy for all man-caused fires in this study was 79 percent, a probability which administrators would accept as sufficiently reliable as a basis for fire planning. Third, the accuracy of the smoker category, and possibly of the incendiary class, is markedly below that of any other cause. The conclusion here is that most guesses are called smoker fires.

To check this last conclusion, the accuracy of the smoker and the incendiary categories was checked against the accuracy of all other groups combined. For the smoker category the chi-square value (52.78) was significant well beyond the 1 percent level, showing that investigators do indeed throw their unknown fires into this class. The value of chi-square for incendiary fires (3.52) was not significant.

Analysis of the figures on "class of people responsible" reveals a similar pattern (Table 2). Again, the average accuracy for the total number of fires is acceptable as a basis for administrative decisions; however, investigators seem reluctant to call a fire of local origin if there is any possibility of doubt. This inference was confirmed by the chi-square test which shows a significant difference between the accuracy of the resident group against any other group or against all other groups combined.

A further check was made by analyzing the law enforcement reports which listed the fire cause as local, outsider, or unknown. Of the 158 fires studied, 83 were called local, 56 outsider, and 19 unknown. The ratio of locals to outsiders is 6 to 4, a figure that has been used for planning purposes in Region 5 for many years. However, when the reliability of these figures was examined, we found that only 8 of the 83 fires attributed to locals were based on guesswork while 37 of the 56 fires charged to outsiders were guessed. Of the 94 fires whose origin is positive or reasonably certain, 75 were started by local residents and only 19 by outsiders, a ratio of 8 to 2 rather than 6 to 4.

It may be argued that more of the fires caused by outsiders are hard to determine accurately because these people are transient. This is true to a certain extent, but examination of the records of those fires listed as outsider by guesswork shows that the great majority are hunter-, and fisherman-caused and in areas where hunting and fishing pressures by local residents are great. There is no reason to assume, as our investigators do, that every unknown hunter who starts a fire in the woods must be a vacationer from outside the area.

In addition to checking the accuracy of the data themselves, the records were studied to see whether size of fire, season, agent of discovery, or land ownership caused any difference in the accuracy of investigations.

The only significant difference in the accuracy of investigation was in the land ownership factor (Table 3). Data on fire causes for fires starting on national forest lands evidently are poorer than those for fires starting off-forest because the bulk of the hard-to-prove fires (smoker and sportsman) start on the national forests.

The possibility that investigating procedures might have been improved because a study was being made was also checked. The accuracy of fires investigated in 1955, before the study started, was compared with the 1956 fire record. There was no significant difference.

TABLE 2.—PROBABLE ACCURACY OF "CLASS OF PEOPLE" ESTIMATES

Class of people	Number of fires in category 1	2	3	4	Total	Average accuracy
Recreationist	8	16	13	12	49	.67
Traveler	2	0	4	1	7	.62
Resident	28	8	3	0	39	.94
Other	33	10	6	14	63	.68
Total	71	34	26	27	158	.78

TABLE 3.—ACCURACY OF FIRE CAUSE ESTIMATES BY SIZE, DATE OF ORIGIN, DISCOVERY, AND LAND OWNERSHIP

Item	Number of fires in category 1	2	3	4	Total	Average accuracy
Size class						
"A"	37	14	30	5	86	.77
All other	33	20	12	7	72	.82
Month						
June-September	50	36	32	6	114	.81
October-May	20	8	10	6	44	.78
Discovered by						
Lookout or Forest Service	26	13	20	4	63	.78
Other	44	21	22	8	95	.81
Land ownership						
National Forest	33	18	27	9	87	.75
Other	37	16	15	3	71	.84

Conclusions

What do all these figures mean to the people actually planning fire-control and fire-prevention programs in California? First, and most important, they show that data on fire causes in the California Region are sufficiently accurate to serve as a basis for planning such programs. They also show that we have a bad habit of lumping nearly all our unknown fires into the smoker class and that the statistics on smoker fires are apt to be misleading unless this fact is recognized.

In planning prevention programs, particularly at the local level, the fact that nearly 80 percent of the fires whose cause is known are started by local residents—rather than the 60 percent formerly recognized—is especially significant. The educational approach in prevention must be tied to protecting those values that are of primary importance to the people starting the fires. In general, Californians should gear prevention campaigns more closely to the needs of local residents to get the maximum pay-off in reduced fire occurrence.

An Aid for Climbing with a Rope and Saddle

A quick safe method for climbing in large hardwood trees was devised for a research project. It is a method that could be of value to both foresters and wildlife biologists when high climbing is necessary.

After trying various climbing procedures involving ladders and ropes, it was found that the climbing rope (or safety line) and saddle was the safest and most efficient. Blair[1] and Eversole[2] describe this equipment. Eversole also describes the "Tarzan Method" (climbing from branch to branch) for getting up the tree before securing the rope and saddle. A simple method for getting into trees with few low branches, which is ordinarily used by tree trimmers, is to toss one end of the climbing rope over a low limb. A weight attached to a light line can be used to get the rope over higher branches, 20 to 30 feet in height. The climber can then raise himself gradually by pulling down on the rope and sliding the taut-line hitch to hold the slack.

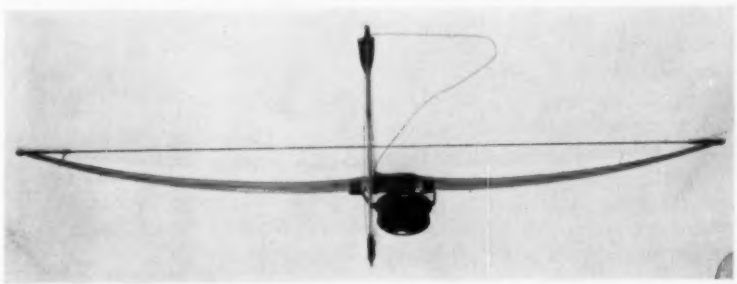


FIG. 1.—A bow fitted with a fishing reel for putting a line over high branches. A casting line is attached to the arrow which is weighted at the tip end.

The main problem on large tall trees with clear boles is to get the rope over a strong limb 40 to 70 feet from the ground. After experimenting with different methods, it was determined that this could be done easily and quickly with a bow fitted with a bow fishing reel, fish line, and a weighted arrow fastened to the line at the nock end and near the tip or point in the same manner as a fishing arrow. A 25-pound-test casting line was used with an inexpensive arrow and a 40-pound bow (Fig. 1).

With a little practice it is possible to put the arrow and line over a selected limb 60 to 70 feet from the ground in one to three tries. The arrow is then removed and a light sash cord is attached to the casting line and pulled over the branch. The climbing rope is attached to the sash cord and also pulled over the branch. The saddle is attached to the rope. By having a helper on the ground pull the rope as the climber pulls to ascend, a 60-foot climb can be made in a few minutes.

L. W. GYSEL
Fisheries and Wildlife Department,
Michigan State University,
East Lansing

[1]Blair, G. D. Tree clearance for overhead lines. Electrical Publications Inc., Chicago. 2nd ed. Rev. 1951.

[2]Eversole, K. R. Using the climbing rope and saddle in forestry. Jour. Forestry 52:285-286. 1954.

Deer Browsing and Douglas-Fir Seedling Growth in Northwestern California

D. F. Roy

MY FATHER was 14 years old when he saw his first deer. And he was not a city boy. Instead, he was reared on a ranch in northern California. Today, in the same area, deer can be seen every day—sometimes scores of them.

Recent studies by big-game zoologists confirm the opinion commonly held by many observant suburban home owners, ranchers, and foresters—that deer have become more numerous in the state during the last 50 years (*1, 6, 7, 10*).

Land managers' interest in the browsing damage to conifers caused by the Columbian blacktailed deer (*Odocoileus hemionus columbianus* [Richardson]) in the northwestern part of the state recently has increased.[1] Many want to learn more about deer browsing, its seriousness, and its relationship to forest management. To date no data on this subject have been available for the area.

Concurrently with other Douglas-fir (*Pseudotsuga menziesii* [Mirb.] Franco) regeneration studies, deer browsing damage, or the lack of it, has been observed on three heterogeneous sites within the natural range of Douglas-fir in northwestern California. Although deer sometimes browse the tips of lateral branches, this report is concerned only with terminal growth. Results are recorded here to help interested persons understand and evaluate the problem.

Slate Creek Unit

The first area where deer browsing was observed is the Slate Creek Unit, about 7 miles north, and slightly east, of Weaverville, Trinity County. This unit was logged in 1950 and 1951. Paired one-tenth-acre plots, designed to compare the performance of ponderosa pine (*Pinus ponderosa* Laws.) and Douglas-fir seedlings on various microaspects, were planted in late April and early May of 1952. The area on the clearcut block surrounding the test plantings also was planted. Survival and growth on the experimental blocks were

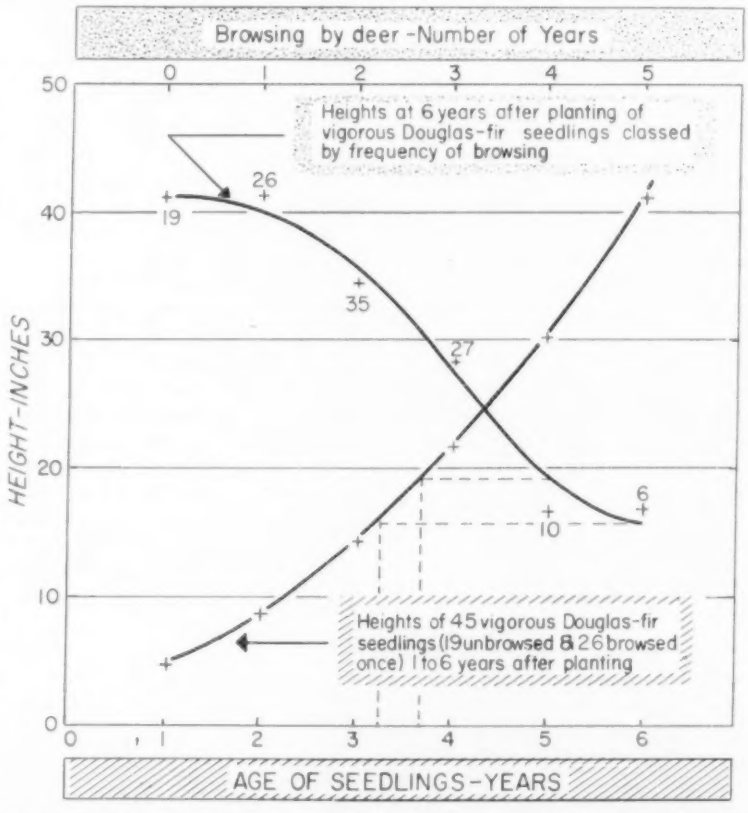


FIG. 1.—Height growth of vigorous Douglas-fir seedlings, Brush Mountain Unit, Six Rivers National Forest.

THE AUTHOR is with the Pacific Southwest Forest and Range Expt. Sta., Berkeley, Calif.

[1]Letter from Larry T. Marshall, consulting forester, Arcata, June 7, 1958.
Statement by William J. Kerr, joint hearings, State Senate Interim Committee on the Economic Redevelopment of Cutover Timber Areas and Brush Lands and State Senate Interim Committee on Forest Practices, Eureka, Aug. 22, 1958.
Minutes of Technical Advisory Committee, (Humboldt County) Department of Forestry Office, Jan. 26, 1959.
Minutes of Technical Advisory Committee, (Humboldt County) Department of Forestry Office, Feb. 23, 1959.

TABLE 1.—DEER BROWSING DAMAGE TO CONIFERS PLANTED IN THE SPRING OF 1952, SLATE CREEK UNIT, TRINITY NATIONAL FOREST

Years after planting	Trees observed		Trees browsed by deer		
	Douglas-fir	Ponderosa pine	Douglas-fir	Ponderosa pine	All
	Number		*Percent*		
2	412	522	3.4	2.5	2.9
3	385	588	6.2	1.7	3.5
4	387	580	1.6	0.9	1.1
5	405	597	0.2	0.3	0.3
6	387	572	1.8	0.0	0.7
Annual average	395	572	2.6	1.0	1.7

TABLE 3.—SURVIVAL AND HEIGHT GROWTH OF BIGLEAF MAPLE SEEDLINGS, AND RELATED DEER BROWSING, SLATE CREEK UNIT, TRINITY NATIONAL FOREST

Years after logging	Survival	Heights		Number browsed
		Average	Range	
	Percent	*Inches*		*Percent*
1	85	3.9	1.6- 8.9	0
2	—	—	—	—
3	79	9.9	3.5-21.6	67
4	74	12.7	4.2-24.8	84
5	53	18.7	5.9-36.6	100
6	53	16.9	6.5-35.0	100
7	53	26.2	8.0-64.0	72

Basis: 34 seedlings.

followed through the 1958 growing season. The development of competing vegetation also was measured.

Deer browsing damage to conifers at Slate Creek was extremely light (Table 1). Heaviest browsing, 6.2 percent of the trees, was suffered by Douglas-fir in the third growing season. Over the 5-year period of observation browsing damage was somewhat heavier to Douglas-fir than to ponderosa pine. During this period, 1954-1958, deer browsed, on the average, 2.6 percent of the Douglas-fir seedlings and 1.0 percent of the ponderosa pine.

Height growth of the planted trees was satisfactory. Douglas-fir averaged 3.4 feet six years after planting, and the average ponderosa pine was 3.0 feet tall. The tallest Douglas-fir reached 11.8 feet, the tallest ponderosa pine 10.3 feet (Table 2).

A heavy crop of bigleaf maple (*Acer macrophyllum* Pursh) seed produced in 1951 established 340 seedlings per acre in the same area. Deer browsing on these seedlings has been heavy (Table 3). It was particularly heavy during the fifth to sixth year period when the average seedling height was reduced from 18.7 inches to 16.9 inches. One seedling was browsed so severely that it was reduced in height by 12.6 inches. Other individual bigleaf maple seedlings were browsed back 7.2, 6.6, and 5.5 inches, respectively.

The development of vegetation competing with conifer reproduction on the logged area was recorded. Growth of dogwood sprouts was a part of this study and has been reported (*8*).

Dogwood (mostly Pacific dogwood [*Cornus nuttallii* Aud.] with some blackfruit dogwood [*C. sessilis* Torr.]) covered 3.2 percent of the ground area in 1957, six years after logging. It was well distributed: 29 percent of the milacres sampled had some dogwood cover.

Browsing of dogwood was not as severe as for bigleaf maple, but was appreciable (Table 4). Although more dogwood sprout clumps (70 percent) were browsed during the sixth year after logging than during the preceding years, the intensity of browsing on individual clumps decreased with each successive year.

Observations at Slate Creek affirm the well known fact that deer are selective in their browsing (*3, 9*). Enough bigleaf maple, dogwood, and other browse species preferred by deer over conifers grow in this area to eliminate significant browsing on Douglas-fir and ponderosa pine.

TABLE 2.—HEIGHT GROWTH OF CONIFERS PLANTED IN THE SPRING OF 1952, SLATE CREEK UNIT, TRINITY NATIONAL FOREST

Years after planting	Trees observed		Heights			
			Douglas-fir		Ponderosa pine	
	Douglas-fir	Ponderosa pine	Average	Range	Average	Range
	Number		*Feet*			
2	398	544	1.0	0.1- 2.7	1.1	0.2- 3.3
3	385	586	1.4	0.2- 4.9	1.5	0.2- 4.4
4	381	580	2.0	0.1- 6.9	2.0	0.3- 6.3
5	397	557	2.7	0.4- 9.9	2.5	0.3- 7.8
6	385	561	3.4	0.4-11.8	3.0	0.2-10.3
Annual average	389	566	—	—	—	—

Brush Mountain Unit

Survival and growth of Douglas-fir seedlings and the incidence of deer browsing also have been studied in plantations on the Brush Mountain Unit, Six Rivers National Forest. The seedlings are growing on clearcut blocks located about three miles west of Salyer. These blocks were logged in 1952, and planted between March 25 and April 21, 1953.

Deer browsing damage to the seedlings has been moderately severe (Table 5). On the average, 25 percent of the trees have been browsed each year, with the number of seedlings damaged ranging from none during the first year to 53 percent in the fourth.

Repeated browsing has reduced height growth appreciably (Table 6 and Fig. 1). The amount of setback measured by growing-time was determined as follows:

1. The seedlings classified as vigorous in the last three years were segregated into groups according to the number of years they had been browsed.

2. The average heights at the

TABLE 4.—BROWSING OF DOGWOOD SPROUTS, SLATE CREEK UNIT, TRINITY NATIONAL FOREST

Years after logging	Sprout clumps examined	Number of sprout clumps browsed by deer			
		Light	Medium	Heavy	Total
	Number	*Percent*			
3	50	—52—		10	62
4	50	14	24	8	46
5	50	28	4	8	40
6	50	62	6	2	70

TABLE 5.—DEER BROWSING DAMAGE TO DOUGLAS-FIR SEEDLINGS OF ALL VIGOR CLASSES DURING A SIX-YEAR PERIOD, BRUSH MOUNTAIN UNIT, SIX RIVERS NATIONAL FOREST, 1953-1958

Years after planting	Trees observed	Trees browsed by deer	
	Number	*Number*	*Percent*
1	241	0	0
2	215	41	19
3	206	56	27
4	191	102	53
5	184	40	22
6	179	61	34
Annual average	203	50	25

end of the sixth growing season were calculated and plotted.

3. Another curve, showing the average heights by age for vigorous seedlings which were unbrowsed or browsed only once, was plotted on the same graph.

4. Points on the two curves were compared to determine the setback. For example, the "browsing" curve shows that vigorous seedlings browsed 4 times during the six-year period after planting were, on the average, 19.4 inches tall. The "height" curve shows that this average height should have been reached at 3.7 years of age. Therefore, there was a height-growth setback of 6.0 years minus 3.7 years, or 2.3 years' growth (Table 7). Five years of browsing set Douglas-fir seedlings back in height growth an average of 25.2 inches and 2.7 years in growing time.

The development of vegetation competing with conifer seedlings also was studied on the Brush Mountain Unit. The browse species growing on the clearcut blocks have been ranked by palatability classes, and the ground surface area occupied by them has been recorded (Table 8). In 1956, when deer browsing on Douglas-fir seedlings was heaviest (53 percent) (Table 5), preferred browse species covered only 3.6 percent of the ground area, and the total area covered by browse was only 7.3 percent. This amount of browse is meager compared to range management standards. The relative scarcity of preferred browse explains the moderately severe deer browsing damage suffered by Douglas-fir seedlings on the area.

TABLE 6.—DEER BROWSING ON PLANTED DOUGLAS-FIR SEEDLINGS CLASSED AS VIGOROUS, BRUSH MOUNTAIN UNIT, SIX RIVERS NATIONAL FOREST, 1953-1958

Number of years browsed	Trees browsed by deer		Heights of seedlings six years after planting	
			Average	Range
	Number	*Percent*	*Inches*	
0	19	15	41.0	22.4-75.6
1	26	21	41.2	17.2-96.8
2	35	29	34.6	14.3-99.8
3	27	22	28.2	14.0-55.4
4	10	8	16.8	11.8-32.5
5	6	5	17.1	15.1-23.0
6	0	0		
Total	123	100		

Swanson Unit

The third area where planted conifers were measured is the Swanson Unit, Six Rivers National Forest. It is located slightly more than 2 miles east and about 1 mile south of Salyer. This unit consists of 14.7 acres logged in August and September, 1951, and planted with Douglas-fir and a few Jeffrey pine (*Pinus jeffreyi* Grev. & Balf.) seedlings in the spring of 1952.

Tanoak (*Lithocarpus densiflorus* [Hooker and Arnott] Rehder) sprouts and western whipplea (*Whipplea modesta* [Torr.]) aggressively covered most of the area within two years after logging. Other plant species are sparse. An occasional gooseberry or currant (*Ribes* spp. L.) plant can be found on the cutover, but deerbrush (*Ceanothus integerrimus* H. & A.), the only preferred browse species on the unit, is less common. It covers less than 1 percent of the ground area and has been severely hedged by deer.

Some Douglas-fir seedlings—those growing close to or within hardwood sprout clumps—have been protected from deer browsing, but almost every tree growing in the open has been browsed heavily each year since planting. In contrast, Jeffrey pine was not browsed except in the fourth and fifth years.

To evaluate the browsing damage, two strips, each 10 links (6.6 feet) wide, were run through the area. Planted conifers on the strips were classified as "protected" or "unprotected" from deer browsing, and were measured for height growth. Almost 79 percent of the Douglas-fir seedlings were classified as unprotected. These trees, planted six years previously, ranged in height from 3.3 to 22.7 inches, averaging 11.0 inches (Table 9). Trees protected from browsing by growing within or close to hardwood sprout clumps ranged from 20.8 to 55.7 inches tall and averaged 39.7 inches. All the Jeffrey pine seedlings were planted on skid roads where they were readily accessible to deer. Height growth for this species six years after planting ranged between 20.4 and 62.0 inches and averaged 37.5 inches.

The measurements indicate a strong preference by deer for

TABLE 7.—EFFECT OF REPEATED DEER BROWSING ON SIX-YEAR HEIGHTS OF VIGOROUS DOUGLAS-FIR SEEDLINGS, BRUSH MOUNTAIN UNIT, SIX RIVERS NATIONAL FOREST

Number of years browsed	Height growth setback (from Fig. 1)	
	Years	*Inches*
0	0.0	0.0
1	0.1	1.1
2	0.5	5.3
3	1.3	13.2
4	2.3	21.7
5	2.7	25.2

Douglas-fir over Jeffrey pine, and demonstrate that deer browsing damage to conifers may be severe when preferred browse species are scanty or absent. Comparison of the average heights six years after planting for protected and unprotected Douglas-fir shows (Fig. 1) that deer browsing reduced the average height by an amount equivalent to 3.6 years' growth.

TABLE 8.—BROWSE SPECIES PRESENT, PALATABILITY RATING, AND AMOUNT OF GROUND SURFACE COVERED, BRUSH MOUNTAIN UNIT, SIX RIVERS NATIONAL FOREST, 1955-1957

Species	Palatability rating[1]	Amount of ground surface covered		
		3rd year	4th year	5th year
		Percent		
Manzanita (*Arctostaphylos* spp. Adans.)	Practically worthless	0.1	0.1	0.1
Golden chinkapin (*Castanopsis chrysophylla* [Dougl.] A.DC.)	Poor	0.3	0.2	0.3
Gooseberry and currant (*Ribes* spp.L.)	Poor	0.6	1.6	1.1
California hazel (*Corylus rostrata* Ait. var. *californica* A.DC.)	Fair	0.1	0.1	0.1
Longleaf mahonia (*Berberis nervosa* Pursh)	Fair	0.1	0.2	0.1
Snowbrush (*Ceanothus velutinus* Dougl.)	Fair	1.1	1.5	3.5
Pacific dogwood (*Cornus nuttallii* Audubon)	Fairly good	0.1	0.3	0.1
Poison oak (*Rhus diversiloba* T. & G.)	Fairly good	0.5	0.7	0.8
Western raspberry (*Rubus leucodermis* Dougl.) and California blackberry (*R. spectabilis* Pursh)	Good	1.3	2.2	2.5
Bigleaf maple (*Acer macrophyllum* Pursh)	Very good	(T)[2]	(T)	—
California wild rose (*Rosa californica* C. & S.)	Excellent	0.3	0.4	0.4
Subtotal—preferred browse species		2.2	3.6	3.8
Total—all browse species		4.5	7.3	9.0

Basis: 560 milacre plots

[1]Palatability ratings are defined in "Range plant handbook" (Forest Service, 1937).

[2](T) indicates less than 0.1 percent.

TABLE 9.—HEIGHTS OF CONIFERS IN 6-YEAR OLD PLANTATION, SWANSON UNIT, SIX RIVERS NATIONAL FOREST

Species	Relation to hardwood sprouts	Seedling basis	Heights of seedlings six years after planting	
			Average	Range
		Number	*Inches*	
Douglas-fir	Unprotected	75	11.0	3.3-22.7
Douglas-fir	Protected	20	39.7	20.8-55.7
Jeffrey pine	Unprotected	18	37.5	20.4-62.0

Conclusions

Damage to conifer seedlings by deer browsing in northwestern California varies from place to place. The severity of browsing damage appears to be related to the amount of preferred browse species growing on an area. Browsing, although generally not fatal to conifer seedlings, seriously reduces height growth when repeated year after year.

Crop and garden damage by deer in California is heavy and continues to increase (*2*). We can expect damage to conifer seedlings to increase also. Deer populations seem to reach maximum densities in areas where vegetation is disturbed, and logging is one of the principal influences which increases the deer-carrying capacity of forest land (*5*). When browse high on the palatability scale is scanty or lacking, the land manager attempting to regenerate a stand of trees is faced with a problem of damage caused by browsing deer.

Our present predicament has been stated nicely as follows: "We have to learn how to live with the deer, to allow and encourage the maximum population with the minimum of damage to their range and to our crops. We have to learn the ways of deer, not only that we may understand and appreciate them more, but that we may encourage them where we want more of them and discourage them where we want fewer. We have to learn how the deer may enrich our lives without damaging our property" (*10*).

Literature Cited

1. ANONYMOUS. 1955. Now is the time to harvest. California Dept. Fish and Game. 14 pp. Illus.
2. BIEHN, E. R. 1951. Crop damage by wildlife in California. California Dept. Fish and Game. Game Bul. 4. 77 pp. Illus.
3. DAHLBERG, BURTON L., and RALPH C. GUETTINGER. 1956. The white-tailed deer in Wisconsin. Wisconsin Conserv. Dept. Game Mangt. Div. Tech. Wildlife Bul. 14. 282 pp. Illus.
4. FOREST SERVICE. 1937. Range plant handbook. U. S. Dept. of Agric. 1150 pp. Illus.
5. LEOPOLD, A. STARKER. 1950. Deer in relation to plant successions. Jour. Forestry 48:675-678.
6. LEOPOLD, A. STARKER, THANE RINEY, RANDAL MCCAIN, and LLOYD TEVIS, JR. 1951. The Jawbone deer herd. Calif. Dept. Nat. Resources, Div.

Fish and Game. Game Bul. 4. 139 pp. Illus.
7. LONGHURST, WILLIAM M., A. STARKER LEOPOLD, and RAYMOND F. DASMANN. 1952. A survey of California deer herds, their ranges and management problems. Calif. Dept. Fish and Game, Bur. Game Conserv. Game Bul. 6. 136 pp. Illus.
8. ROY, D. F. 1955. Hardwood sprout measurements in northwestern California. U. S. Forest Serv., Calif. Forest and Range Expt. Sta. Forest Res. Note 95. 6 pp. Illus.
9. SWANK, WENDALL G. 1958. The mule deer in Arizona chaparral and an analysis of other important deer herds. A research and management study. State of Ariz. Game and Fish Dept. Wildlife Bul. 3. 109 pp. Illus.
10. TABER, RICHARD D., and RAYMOND F. DASMANN. 1958. The black-tailed deer of the chaparral—its life history and management in the north coast range of California. Calif. Dept. Fish and Game, Game Mangt. Branch, Game Bul. 8. 163 pp. Illus.

The Effect of Biocides on the Survival of Mycorrhizal Fungi[1]

D. J. Persidsky and S. A. Wilde

THE AUTHORS have reported in their earlier papers the unfavorable influence of different fungicides and insecticides on fungi symbiotizing with forest trees (*3, 9, 10*). The previous greenhouse and nursery bed trials, however, never provided a convincing evidence of a complete extermination of mycorrhizal organisms by eradicants. Actually, the past experience suggested that some mycorrhizal fungi escape destruction by toxic substances even when such are applied at concentrations lethal to tree seedlings.

A direct detection of the lower symbionts in biocide-treated soils is hindered by the difficulties of isolating the mycorrhiza-forming fungi in pure cultures, the frequent occurrence in the presence of toxic chemicals of the concealed peritrophic association, and the growth-promoting influence of certain eradicants which simulate the effect of mycorrhizae. Therefore, the solution of the problem was approached by inoculation of mycorrhiza-free prairie soils with biocide-treated forest soils which harbored mycorrhizal fungi prior to application of eradicants.

As was found by numerous preceding trials, an addition of 0.5 percent of the autochthonously inoculated forest soil is sufficient to transmit the mycorrhizal fungi to prairie soils. The success of inoculation is expressed in a several hundred percent increased growth of tree seedlings and usually in the formation of mycorrhizal short roots or vesicle-arbuscule aggregates (*6, 4*).

In present trials, thoroughly mixed biocide-treated soils were added to prairie soils at a rate of 2 percent by weight. This amount insured the transmission of the survived organisms and yet did not create the condition of toxicity harmful to tree seedlings or otherwise influence the test plants.

A combination of chlordane, thiosan, and allyl alcohol was first applied to autochthonously-inoculated coarse sandy soil (Plainfield series) in the following two concentrations: *low concentration* (commonly used in nursery practice): chlordane-10 pounds, thiosan-60 pounds, and allyl alcohol-50 gallons per acre; *high concentration* (three times normal): chlordane-30 pounds, thiosan-180 pounds, and allyl alcohol-150 gallons per acre.

Ten days after treatment, the soils were placed in one-gallon glazed jars and seeded to Monterey pine. In cultures treated with a low content of biocides, the seedlings developed normally; in cultures with a triple dose of biocides, the

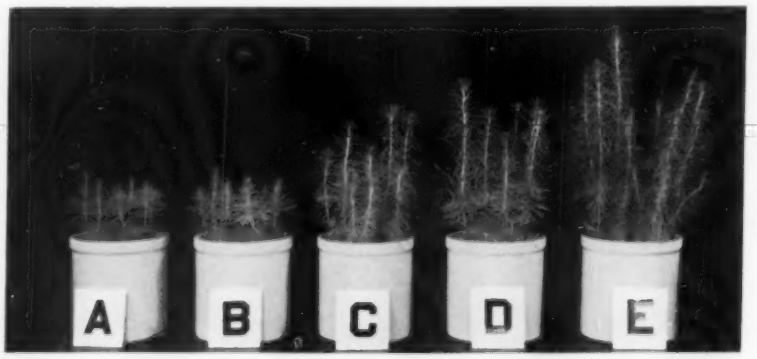


FIG. 1.—Effect of biocides on the survival of mycorrhizal fungi as determined by the growth response of one-year-old Monterey pine to inoculation of prairie soil with biocide-treated forest soil: A—Mycorrhiza-free prairie silt loam; B—Similar prairie soil with 2 percent of forest sandy soil treated with 30 lbs. of chlordane, 180 lbs. of thiosan and 150 gallons of allyl alcohol per acre; C—Similar prairie soil with 2 percent of forest soil treated with 10 lbs. of chlordane, 60 lbs. of thiosan and 50 gallons of allyl alcohol per acre; D—Untreated forest sandy soil autochthonously inoculated with mycorrhizal fungi; E—Prairie soil with 2 percent of untreated forest soil.

THE AUTHORS are research associate in soils and professor of soils, respectively, University of Wisconsin, Madison.

[1]Contribution from Soils Department, University of Wisconsin, in cooperation with Wisconsin Conservation Department. Publication approved by the director of the Wisconsin Agric. Expt. Sta.

growth of trees was reduced about 60 percent on an oven-dry basis.

The plants were removed from the jars at the age of six months, and the soil was used for inoculation of a virgin prairie soil (Carrington silt loam). A motor-driven rotating drum was employed to insure a thorough distribution of the biocide-treated soil and prairie soil. The prairie soil was then placed in half-gallon glazed jars and seeded to Monterey pine. Eleven months later a record was taken of the stock development.

The results, presented in Table 1 and Figures 1 and 2, show that under conditions of this study a heavy application of the combined fungicide-insecticide-herbicide chemicals anihilates the whole population of mycorrhiza-producing organisms. The growth and root morphology of tree seedlings raised on a prairie soil inoculated with a forest soil treated with the heavy dose of erradicants (B) is nearly identical with seedlings raised on the mycorrhiza-free prairie soils (A). On the other hand, a low rate application of biocides permitted the survival of at least some symbiotic fungi, for an addition of thus treated forest soil to prairie soil produced the seedlings (C) comparable to those raised in the untreated forest soil (D). The most significant, however, is that the growth of trees in these cultures was far behind the growth of seedlings raised in prairie soil inoculated by an addition of untreated forest soil (E). This indicates that the fungi which have survived biocide treatment possess a considerably decreased efficiency in promoting the growth of tree seedlings. The deterioration of the biological factor should be attributed to the reduced number of organisms and perhaps to their temporary inactivation by toxic chemicals.

The slower growth of seedlings on the untreated forest soil (C) than on the prairie soil inoculated with a biocide-free forest soil (E) is explainable by the low supply of nutrients, especially nitrogen, present in the sandy forest soil.

TABLE 1.—EFFECT OF BIOCIDES ON THE SURVIVAL OF MYCORRHIZAL FUNGI AS DETERMINED BY THE GROWTH RESPONSE OF ONE-YEAR-OLD MONTEREY PINE TO INOCULATION OF PRAIRIE SOIL WITH BIOCIDE-TREATED FOREST SOILS

Designation of cultures	Type of growing media	Oven-dry weight of ave. seedling	Color of foliage	Occurrence of mycorrhizal short roots
A	Mycorrhiza-free prairie soil	0.045	Pale yellow green	None
B	Prairie soil plus 2% forest soil treated with a heavy dose of biocides	0.057	Pale yellow green	None
C	Prairie soil plus 2% of forest soil treated with a light dose of biocides	0.076	Green	None
D	Untreated forest soil	1.061	Dark green	Sparse bifurcate
E	Prairie soil plus 2% untreated forest soils	1.431	Dark green	Sparse bifurcate

The amazing effect of mycorrhizae is demonstrated by the difference in the growth of seedlings with and without inoculation (A and E).

Under conditions of actual nursery practice, the unequal distribution of chemicals and accumulation of the residues from repeated treatments at times lead to a much higher concentration of eradicants than was used in this study (*5*). Therefore, the use of biocidic compounds calls for special measures of detoxication and reinoculation of nursery soils. The application of peat and other buffering materials, deep rototilling, periodic additions of leaf mold, and the use of liquid humates are among the simple and yet efficient methods of restoring the fertility of biocide-treated soils (*1, 2, 7, 8*).

Summary

Forest soil harboring mycorrhizal fungi was treated with a combination of chlordane, thiosan

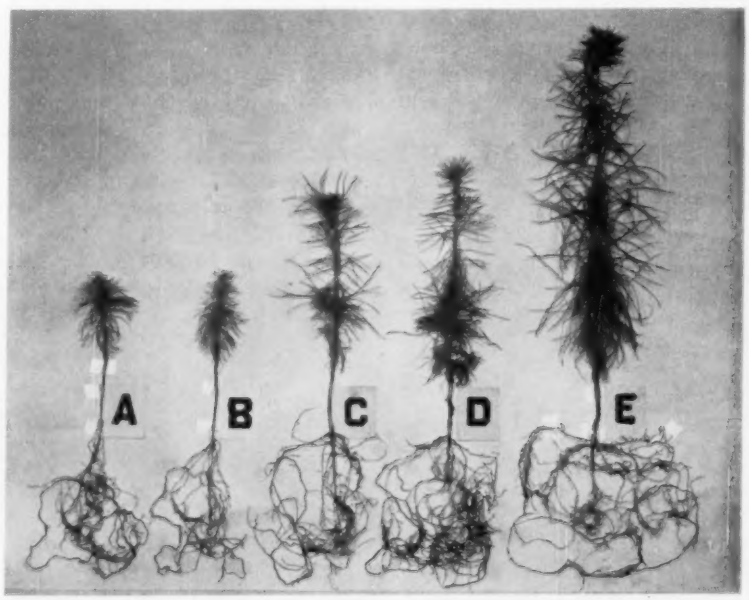


FIG. 2.—Gross morphological features of one-year-old Monterey pine seedlings in the following media: A—Mycorrhiza-free prairie silt loam; B—Similar prairie soil with 2 percent of forest sandy soil treated with 30 lbs. of chlordane, 180 lbs. of thiosan and 150 gallons of allyl alcohol per acre; C—Similar prairie soil with 2 percent of forest soil treated with 10 lbs. of chlordane, 60 lbs. of thiosan and 50 gallons of allyl alcohol per acre; D—Untreated forest sandy soil autochthonously inoculated with mycorrhizal fungi; E—Prairie soil with 2 percent of untreated forest soil.

and allyl alcohol, applied at different rates. In order to find out the effect of these toxic chemicals on the survival and behavior of mycorrhizal fungi, the biocide-treated soil was used for inoculation of mycorrhiza-free prairie soils. The latter were seeded to Monterey pine and the subsequent growth of seedlings revealed that a heavy application of eradicants completely annihilates the mycorrhiza-forming organisms. A light application of the chemicals has permitted the survival of some fungi, but depressed about 50 percent their growth-promoting efficiency. Several simple methods of reestablishing fertility in biocide-treated soils are suggested.

Literature Cited

1. MATSUI, MITSUMA. 1958. The effects of sawdust compost on the growth of Monterey pine seedlings raised on biocide-treated soils. Proc. Forest Soils Conf., State Univ. of Mich., East Lansing, Mich. 150-152.
2. PERSIDSKY, D. J. 1957. Mineral colloids modify the effects of eradicants. Univ. of Wis. Forestry Research Notes, No. 32. Madison, Wis.
3. ———, and S. A. WILDE. 1955. Effect of eradicants on the microbiological properties of nursery soils. Wis. Acad. Sci., Arts and Lett. 44:65-73.
4. ROSENDAHL, R. O. 1942. The effect of mycorrhizal and non-mycorrhizal fungi on the availability of difficultly-soluble potash and phosphate minerals. Soil Sci. Soc. Am. Proc. 7:477-479.
5. WALLIS, G. W. 1959. Effect of biocides on the growth of seedlings of Monterey pine, black locust, and European alder, and the development of their symbiotrophic organs. Univ. of Wis. Forestry Research Notes, No. 45. Madison, Wis.
6. WHITE, D. P. 1941. Prairie soil as a medium for tree growth. Ecol. 22: 398-407.
7. WILDE, S. A. 1937. The use of liquid humate fertilizers in forest nurseries. Jour. Forestry 35:388-392.
8. ———. 1958. Marketable sawdust composts; their preparation and fertilizing value. Forest Products Jour. 8:323-326.
9. ———, and D. J. PERSIDSKY. 1956. Effect of biocides on the development of ectotrophic mycorrhizae in Monterey pine seedlings. Soil Sci. Soc. Am. Proc. 20:107-110.
10. ———, G. K. VOIGT, and D. J. PERSIDSKY, 1956. Transmitted effect of allyl alcohol on growth of Monterey pine seedlings. Forest Sci. 2:58-59.

Forestry in the U. S. Virgin Islands

Robert W. Nobles

GREATER prosperity and economic independence are the long-range goals of the resource development plan now established in the U. S. Virgin Islands. The Virgin Islands Forestry Program is a modest, although vital, segment of this comprehensive development plan.

THE AUTHOR is a forester of the U. S. Forest Service administering the forestry program of the Virgin Islands Corporation, Kingshill, St. Croix, U. S. Virgin Islands.

Columbus discovered the island of St. Croix on his second voyage to the New World in 1493. When he sailed north from St. Croix, on the Feast Day of St. Ursula, he saw a large group of islands and named them for St. Ursula and her 11,000 Virgins. Nowadays, St. Croix is grouped with St. Thomas and St. John and all three islands are administered as the U. S. Virgin Islands. The remaining islands in the group make up the British Virgin Islands. Before the United States purchased the three islands from Denmark in 1917, sovereignty passed from Spain, to England, to Holland, to France, and to the Knights of Malta. Since Denmark governed the islands from 1733 to 1917, it is not surprising that it has exerted a far greater influence on the islands than all the other nations.

Puerto Rico lies 50 miles west of the Virgin Islands, and the islands of the Lesser Antilles swing east and south to the coast of South America. Latitudes 17 and

FIG. 1.—View of steep brush covered slopes on Cane Bay Estate, northwestern St. Croix, suited for underplanting with mahogany.

FIG. 2.—Secondary forest of tan-tan suited for underplanting with mahogany. Solitude Estate, St. Croix.

Left

FIG. 3.—Two-year-old *Swietenia macrophylla* seedlings underplanted on hillside and subsequently liberated. Kingshill Estate, St. Croix.

Above

FIG. 4.—Growth plot on Thomas Estate, St. Croix, showing well formed stand of *Swietenia mahagoni* after stand improvement.

18 degrees north are shared with the Virgin Islands by Mexico City, and longitudes 64 and 65 degrees west are identical with Nova Scotia.

Denmark divided the three islands into large sugar estates, each totaling about 150 Danish acres. Today these estates are identified by the unique, round stone sugar mills and the ruins of the stately great-houses. They bear such interesting names as Anna's Hope, Peter's Rest, Mary's Fancy, Betsy's Jewel, Barren Spot, Paradise, Envy, Hope, Blessing, Slob, Upper Love, Lower Love, and Jealousy. Today most of the acreage is still in large land holdings.

Responsibility for the administration of the islands was given to the Navy Department when the United States purchased the three islands for $25,000,000 in 1917. Since 1931, the islands have been under the jurisdiction of the Department of the Interior. The Governor is appointed by the President of the United States, and in 1958, for the first time, this appointment was given to a native-born Virgin Islander, John David Merwin. Legislative power is invested in a body of 11 senators, elected for two years.

St. Thomas is the most cosmopolitan of the Islands, has the principal harbor, and is the seat of government. It is extremely rough and mountainous, covered with secondary forest and brush, and contains very little agricultural land. Tourism provides the largest income.

St. John is the smallest of the three islands and has fewer than 1,000 inhabitants. About 60 percent of the land area is now included within the boundaries of the new Virgin Islands National Park. The island is steep and blanketed with secondary forests; it once supported a healthy bay rum industry.

St. Croix, the largest of the three islands, contains 52,000 acres, including 6,500 acres of agricultural land which is chiefly devoted to sugarcane production. The island's population of 14,000 is about equal to the population of St. Thomas. Although sugarcane is the number one crop and provides the number one income, the island has a growing livestock industry. St. Croix is only 23 miles long, yet the vegetative cover varies from cactus on the east end to lush, tropical growth on the northwest mountains. Mean temperatures vary from 71 to 86 degrees. Rainfall varies from 30 inches in the east to 50 inches in the west, and the so-called dry and wet seasons are frequently unpredictable. Although tropical storms are common, a full-force hurricane has not struck since 1928. Sugar producing valleys and unproductive, secondary forest hillsides characterize the island. The demand for charcoal has been so great that few large trees and few good species remain.

Recognizing a need for a forest policy, the old Bureau of Efficiency asked the U. S. Forest Service for an investigation and recommendations in 1930. A resident forester carried out a modest program of research and planting during the next two years. Inadequate transportation and the difficulty of access to the rough planting sites resulted in the planting of only 18 trees per man-day (today about 100 are planted per man-day). Undependable weather, high costs, and a disinterested public forced the abandonment of this young

FIG. 5.—General view of nursery at St. Croix with potted mahogany stock in the foreground.

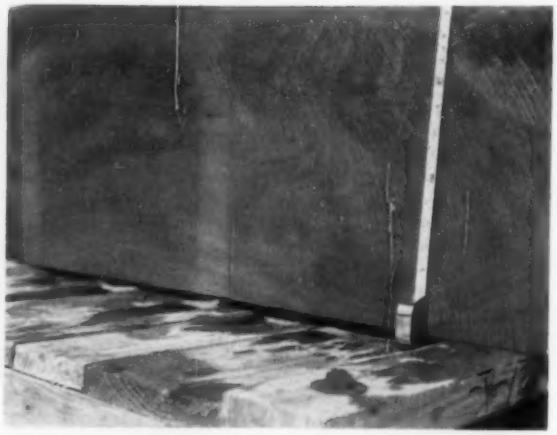


FIG. 6.—West Indies mahogany board showing flat cut with swirl. Sion Farm, St. Croix.

program in 1932. However, the Forest Service staff in Puerto Rico continued to make occasional surveys and investigations, in cooperation with other agencies, from 1940 to 1952. The foundation for the present forestry program was laid in 1953 when the Virgin Islands Corporation (VICORP) alloted $5,000 for use by Forest Service personnel. At the same time, VICORP set aside a 132-acre tract (Thomas Estate) for forest research. The Soil Conservation Service and Agricultural Research Service assisted this modest cooperative venture.

Today the Virgin Islands Forestry Program is financed by annual Grant Funds of $30,000 to VICORP and administered by the Tropical Forest Research Center (TFRC) of the U. S. Forest Service in Puerto Rico. TFRC provides the forester and forestry aide who reside on St. Croix and are directly responsible for the program on the three U. S. Virgin Islands.

Primary concern of the forestry program is assistance to private landowners in the establishment of productive forest without encroaching upon the demands of other land uses. West Indies mahogany (*Swietenia mahagoni*) and Honduras mahogany (*Swietenia macrophylla*) are being underplanted on steep, rough, brush-covered slopes and existing forest resources are being improved, protected, and utilized. Although the program deals primarily with privately owned land, the lands belonging to the government of the Virgin Islands and the federal lands managed by VICORP are also being improved. Most of the work of the program is carried out on St. Croix.

Artificial regeneration.—Most of the steep slopes are covered with dense, worthless bush. Slopes that are sheltered from the trade winds could produce excellent mahogany. The West Indies mahogany was not an element of the original forest, but it has regenerated naturally since its introduction about 1770. Honduras mahogany was introduced in 1907. Proper forest management could furnish, after a period of years, a steady crop of high-grade mahogany.

Mahogany seed is readily available locally and is sowed directly into 5-inch plastic pots in the nursery on St. Croix. About 18,000 potted mahogany seedlings are produced each year. The seed is usually collected in February, sown in March or April, and the seedlings taken to the field for planting during the fall rains. Mahogany is planted 10 feet apart in cleared strips, which are 25 feet apart. These strips, which are cleared with machete and pulaski, are three feet wide and extend up and down the slope, but avoid the crest of the slope, which has proven too rocky, dry, and exposed for good survival. This spacing gives 180 trees per acre. VICORP provides the trees and planting supervision, and the landowner reimburses VICORP for planting costs. Generally, it is unnecessary to solicit planting sites and financial cooperation since the landowners have sufficient interest in the forestry program to make the initial contact.

Burma teak (*Tectona grandis*) was introduced to St. Croix in December, 1954, and a total of 35,000 stumps have been planted on about 35 acres. Although teak shows promise as a tree crop for St. Croix, it may never be extensively planted since it cannot compete with the brush on the steep slopes and it must compete economically with beef cattle and sugarcane on the better lands.

Forest improvement.—Estates Bellevue, Princess, and Thomas, southwest of the town of Christiansted, St. Croix, contain a natural West Indies mahoginay stand of about 250 acres. Composed mainly of young stems and old wolf trees, this is the largest stand of natural mahogany in the Virgin Islands, but other, smaller stands are scattered to the west. All stands need improvement. Improvement work has begun on Thomas Estate, and assistance to private landowners will be offered in the near future.

Utilization. — West Indies mahogany is a strong, hard wood with beautiful figure and high resistance to termites. Exports from the principal producing areas (Cuba, Jamaica, and Hispaniola) have dwindled to an insignificant volume. Old, overmature trees on St. Croix have been salvaged following tropical storms and residential and road construction, and stand improvement will make additional logs available. The desirability of salvaging this high-grade wood, however small the volume available, prompted VICORP to acquire a surplus American No. 1 sawmill in 1954. Cooperators can now obtain felling, bucking, hauling, milling, and drying services. There has been no need to solicit sales of West Indies mahogany since there is a ready market for all lumber produced. As a development agency, VICORP makes an effort to retain this valuable wood in the Virgin Islands for manufacture and sale—even though there may be steadier markets in Puerto Rico and the United States.

Probably no more than 10,000 board feet can be logged and sawed in any year because of the pressure of other phases of forestry work. Thibet or woman's tongue (*Albizzia lebbek*), a common pasture and hillside tree, is now in demand locally because of its dark chocolate color and its irregular grain, but West Indies mahogany continues to make up 95 percent of the lumber sawed. Although only about 10,000 board feet are produced each year, the lumber brings $500 per thousand board feet on the local market, and slabs, chunks, discs, and odd pieces are sold at the mill at the rate of five cents per pound.

Wood preservation. — Installation of a hot-and-cold bath wood preservative plant was completed in 1959. This plant creates a market for thinnings and for species previously considered weeds. The plant will also reduce the drain on remaining forests and will, for the first time, provide high-grade durable posts for local farms and pastures.

It is easy for Americans to criticize countries whose policies show a lack of proper concern for resource development. Our U. S. possessions also require additional resource development. Under-privileged people of the Virgin Islands merit the prosperity which can result and the Virgin Islands Forestry Program is contributing its share to this large-scale undertaking.

Important Notice to Subscribers

If you change your address please notify the JOURNAL OF FORESTRY, preferably in advance, by letter, post card, or post office form number POD 3573. Be sure to give your old, as well as the new, address with your postal zone number if any.

You should also notify your local post office on postal form number POD 3575 of your change of address. Both postal forms are obtainable at any post office.

Copies of the JOURNAL will not be forwarded by the Post Office Department. Hence, in order to avoid missing your copy as well as to prevent extra expense to the Society in supplying duplicates, you are urged to notify the JOURNAL as soon as you know your new address, a month in advance of change if possible.

JOURNAL OF FORESTRY
425 Mills Building
17th Street at Pennsylvania Avenue, N. W.
Washington 6, D. C.

Effects of Desiccation on Puddled Versus Bare-Rooted Loblolly Pine (Pinus taeda L.) and Longleaf Pine (P. palustris Mill.) Planting Stock[1]

G. K. Slocum and
T. E. Maki

A NUMBER of past investigations, such as those by Zeigler (*5*), Cummings (*1*), and Wakeley (*4*) have demonstrated the harmful effects resulting from over-exposure of the roots of coniferous planting stock to direct sunlight. Two recent studies (Slocum and Maki, *2*, *3*) have also emphasized the protective value derived from dipping the seedling roots in "creamy" clay or loam prior to planting. This puddling practice provides cheap insurance against chance exposure, although it is recognized that in well-organized planting operations excessive drying of roots from direct exposure to sunlight may seldom occur.

There is, however, another form of abuse that planting stock may frequently undergo which could be more serious than direct exposure. This is the gradual and insidious desiccation that has its beginning when the seedlings are yanked out of the beds, and continues on through grading, counting, bundling, and other handling prior to the "mossing down" and baling for transit. The length of desiccation may range from only a few hours to a maximum of two or three days, depending on how well the lifting, grading and packing phases of the job have been synchronized. The duration and intensity of subsequent desiccation is conjectural. It depends on several factors, but conceivably drying in bales could continue for a week or longer. Certainly it has been a common enough experience for planting men to find stock arriving on the planting site with roots having that grey-brittle appearance.

Although storage methods and practices have been investigated in the past, the literature on nursery and planting operations does not deal directly with the problem of gradual desiccation of planting stock nor with means to avoid its probable harmful effects. The authors have found no published information dealing with the effects of gradual desiccation on loblolly or longleaf planting stock, nor with possible benefits that might be derived from puddling the roots as a guard against injury from drying. Accordingly, a test was undertaken on these two species in 1956 to ascertain to what extent prolonged desiccation affects survival and vigor of 1-0 planting stock, and whether puddling of roots produces as marked protective benefits as was observed in the tests on direct exposure. It should be noted that this test involved puddling *at the nursery*, in contradistinction to the puddling at the planting site formerly and still recommended in many more or less popular leaflets on planting.

Procedure

The stock for this test was lifted from the School of Forestry Nursery at Raleigh, North Carolina, on February 14, 1956. Immediately after lifting, it was graded to uniform bundles of ten plantable seedlings each, with the roots kept moist until 55 such bundles of each species had been assembled. Five bundles of each species were first drawn at random and set aside for subsequent laboratory measurements. Another five bundles per species were also randomly drawn and given a mud dip that thoroughly covered the roots up to the collar with creamy clay. These treated bundles and the remaining 45 bundles per species were then placed in heel-in trenches in prepared moist soil in the nursery.

On February 15, 10 bundles of each species were drawn at random, and 5 bundles of both the loblolly and the longleaf stock were then given the root-puddling treatment, after which they were placed in separate cans, i.e., the bare-rooted bundles in one can, the mud-dipped bundles in another, and the cans stored in an unheated machine-shed comparable in quality and warmth of shelter to most grading and packing sheds. This series constituted the seedlings to be subjected to 12 days of desiccation. On February 21, the process was repeated in identical fashion for the stock designated for 6 days of desiccation; similarly, on February 24, the 3-day stock was treated, and on February 26, the 1½-day series was processed. The following day, February 27, all the stock was removed from the respective

THE AUTHORS are respectively late professor of forestry and professor of forest management, School of Forestry, North Carolina State College, Raleigh.

[1]Contribution from the School of Forestry, North Carolina Agric. Expt. Sta., Raleigh. Published with the approval of the director of research as Paper No. 1003 of the Journal Series.

TABLE 1.—CONDITION OF ROOTS

Duration of storage	Loblolly	Longleaf
Days		
1½	Mud, wet; bare, moist	Mud, wet; bare, moist
3	Mud, moist; bare damp	Mud, moist; bare, dry but roots limber
6	Mud, dry but with new white root tips showing; bare, dry but no new roots	Mud, dry; bare, dry
12	Mud, dry but with many new roots; bare, bone-dry, but with a few new roots	Mud, dry; bare, bone-dry. No new roots on either treatment

TABLE 2.—WEATHER CONDITIONS DURING CRITICAL PERIOD

Item	Mean (or total)	Standard error	Range
Temperature (°F)			
Maximum	57.7	±2.2	42-73
Minimum	36.0	±1.9	27-49
Mean	47.1	±1.9	35-61
Humidity (percent)	63.8	±3.6	45-97
Wind velocity (mph)	18.7	±0.8	15-25
Rainfall (inches)	1.65		

cans in the shed and immediately heeled into moist soil in the nursery.

As the stock was being removed from the cans, the condition of the roots was observed and noted as recorded in Table 1.

Weather conditions during the period of "desiccation" from February 14 to February 28, inclusive, were fairly typical of late winter at the Raleigh latitude (approximately 36° N) and are summarized in Table 2.

Although the minimum outside temperatures fell below freezing (32° F) on 5 nights during this period, the shed provided sufficient protection to prevent freezing of the stock.

On the 5 bundles that had been set aside for laboratory examination, the seedlings were measured, weighed, oven-dried, and weighed again to provide a basis for determining green weight-dry weight ratios. According to these measurements, the average loblolly pine in this test would qualify for at least a strong grade No. 2 seedling by Wakeley's (*4*) system of morphological grades, and the longleaf would qualify as grade No. 1 (Table 3).

The seedlings were planted in randomized complete blocks; the 4 desiccation periods and 2 root conditions (mud versus bare), which made a total of 8 unique treatment combinations, were assigned at random by rows within each block, with blocks replicated 5 times. The loblolly pine was planted on March 7 after a week in the heel-in trench; the longleaf was planted on March 10. The species were planted in separate blocks, since it was not intended to make a direct test between species; however, considering the uniformity of the nursery planting site, direct comparisons would be valid and justified.

Results

Survival.—At the end of the first growing season, survival of longleaf averaged 87.6 percent for all treatments combined (Table 4).

The survival of seedlings with mud-coated roots was 94.8 percent in contrast to 80.4 percent for seedlings with bare roots. This mean difference of 14.4 percent is significant at the 1 percent level. Length of desiccation-storage within the 12-day period had no effect on survival of seedlings with the mud protection on the roots. Even the bare-rooted seedlings did not suffer significantly up to 3 days of desiccation, but by 6 days the survival had dropped to 74 percent, or significantly poorer than that of the mud-coated seedlings. After 12 days of desiccation, only half of the bare-rooted seedlings survived the first growing season, and they had clearly been damaged by the prolonged drying.

As was expected, loblolly pine withstood desiccation better than longleaf. None of the seedlings with mud-coated roots died, and even among the bare-rooted seedlings, mortality was negligible except in the series "dried" for 12 days (Table 5).

Even without evaluating their variabilities, these data clearly show that puddling the roots in creamy mud provided good protection. Without the mud coating about one-third of the seedlings subjected to 12 days of "desiccation" failed to survive the first growing season.

Growth.—It was not possible to assess effects of desiccation on longleaf growth, since only a few seedlings reached the stage of height-growth initiation in the first growing season, and observations were not carried beyond it. For loblolly pine, however, a precise assessment of growth was made, since heights after planting had been measured prior to start of new shoot growth in the spring of 1956.

Desiccation resulted in a definite reduction in current shoot growth (Table 6). However, up to six days of desiccation, over-all differences

TABLE 3.—SIZE OF 1-0 LOBLOLLY PINE AND LONGLEAF PINE SEEDLINGS USED IN THE DESICCATION TEST. BASIS: 50 SEEDLINGS PER MEAN

Item	1-0 Loblolly pine Mean	1-0 Loblolly pine Standard error	1-0 Longleaf pine Mean	1-0 Longleaf pine Standard error
Root collar diameter—mm	3.66	±0.095	6.06	±0.247
Length of tops—inches	7.06	±0.181		
Length of roots—inches	7.39	±0.312	7.65	±0.232
Green weight—grams	4.78	±0.140	6.74	±0.456
Dry weight—grams	2.10	±0.045	3.24	±0.068
Ratio dry to green	0.44	±0.004	0.48	±0.002

in shoot growth were not significant, and none of the differences in the mud-coated series was significant. In the bare-rooted series, desiccation somewhere beyond 3 days began to reduce shoot growth significantly. The mean difference of 0.104 feet in favor of mud-coating is significant at the 1 percent level.

Discussion

Longleaf and loblolly pine seedlings appear to readily withstand at least 3 days of desiccation of the type that normally prevails in grading and packing shelters without affecting either survival or vigor of field planting. Thus, it seems safe to assume that stock of these species left in tubs in grading sheds over the weekend or lifted in anticipation of inclement weather, suffers no deterioration in quality so long as the period of desiccation does not greatly exceed 3 days. Beyond this period, bare-rooted stock begins to suffer, and the deterioration is reflected both in survival and subsequent vigor of the planted stock.

Since stock is retained in bales frequently for a week to ten days or even longer, it may well exceed the safe limits of gradual desiccation, particularly if it has been inadequately wetted down at mossing and baling time. Although this study did not test the effects of desiccation in bales, it seems reasonable to assume that drying in bales would have deleterious effects comparable to those incurred from the drying that took place in this test in the absence of any protection to the bare-rooted stock.

The finding that mud-coating of roots gave complete protection against desiccation effects is not surprising in the light of the previously-shown benefits from puddling as protection against direct exposure to sunlight. Both longleaf and loblolly pine apparently withstand gradual drying much better than direct exposure. Against both types of abuse, puddling of roots in creamy clay gives a satisfying measure of protection. Had the test been conducted during warmer weather, the difference might well have been greater than was found.

Nurserymen may regard with horror the suggestion that they provide a "mud gravy" vat at the end of the grading table into which each bundle of stock may be dipped as it comes off the assembly line. This practice admittedly would add to the mess and the cost of preparing stock fir shipment but, if mud-dipped, the bundles would not appear to require mossing. It would also assure that there would be fewer complaints from the men at the planting sites when they open the bales and find the roots of the seedlings with that gray, wan, dry, brittle look. After all, regardless of mess and cost, the whole purpose of nursery operations is to provide seedlings that survive and grow well when planted in the field.

TABLE 4.—AVERAGE SURVIVAL PERCENT OF LONGLEAF PINE SEEDLINGS ON NOVEMBER 12, 1957, APPROXIMATELY EIGHT MONTHS AFTER PLANTING. BASIS: 50 SEEDLINGS PER INDIVIDUAL MEAN

Root treatment	Length of desiccation in days 0	1½	3	6	12	Mean
	Percent					
Mud-coated	94	98	94	94	94	94.8
Bare	94	92	92	74	50	80.4
Both	94	95	93	84	72	87.6

L.S.D.$_{.05}$ for desiccation—15.3 percent.
L.S.D.$_{.05}$ for storage × root treatment means—21.6 percent.

TABLE 5.—AVERAGE SURVIVAL PERCENT OF LOBLOLLY PINE SEEDLINGS ON NOVEMBER 12, 1956, APPROXIMATELY EIGHT MONTHS AFTER PLANTING. BASIS: 50 SEEDLINGS PER INDIVIDUAL MEAN

Root treatment	Length of desiccation in days 0	1½	3	6	12	Mean
	Percent					
Mud-coated	100	100	100	100	100	100.0
Bare-rooted	100	100	100	98	66	92.8
Both	100	100	100	99	83	96.4

TABLE 6.—CURRENT AVERAGE SHOOT GROWTH OF LOBLOLLY PINE SEEDLINGS BETWEEN MARCH 7 AND NOVEMBER 12, 1956

Root treatment	Length of desiccation in days 0	1½	3	6	12	Mean
	Feet					
Mud-coated	0.960	0.998	0.902	0.985	0.893	0.948
Bare-rooted	0.905	0.875	0.969	0.832	0.642	0.844
Both	0.932	0.936	0.936	0.908	0.768	0.896

L.S.D.$_{.05}$ for desiccation means is 0.131 feet.
L.S.D.$_{.05}$ for desiccation × root treatment means, 0.139 feet.

Summary

A study of loblolly and longleaf pine planting stock was undertaken at Raleigh, N. C., in February 1956 to determine the effects of desiccation on seedling survival and vigor. Bare-rooted versus mud-coated roots were subjected to desiccation in an unheated shed for periods of 1½, 3, 6, and 12 days, after which they were planted in replicated randomized plots in prepared soil in the nursery. Survival trends were tallied during the first growing season, and shoot growth of loblolly pine was measured also. At the end of the first growing season it was found that:

1. Survival of longleaf stock with mud-coated roots for all durations of desiccation averaged 94.8 percent, and of loblolly, 100 percent. Bare-rooted stock of longleaf averaged only 80.4 percent, and of loblolly pine, 92.8 percent.

2. Duration of desiccation up to 12 days had no effect on survival of either longleaf or loblolly pine stock with mud-coated roots. With bare-rooted stock, survival of longleaf dropped to 74 percent after 6 days, and to 50 percent after 12

days of desiccation; bare-rooted loblolly stock held up well through the sixth day (98 percent survival), but by the twelfth day, survival dropped to 66 percent.

3. Shoot growth of loblolly stock with the mud-protected roots was unaffected by duration of desiccation, but with bare-rooted stock, 12 days of desiccation reduced current shoot growth 29 percent below the bare-root control stock.

Literature Cited

1. CUMMINGS, W. H. 1942. Exposure of roots of short leaf pine stock. Jour. Forestry 40:490-492.
2. SLOCUM, G. K., and T. E. MAKI. 1956. Exposure of loblolly pine planting stock. Jour. Forestry 54:313-315.
3. ———— and ————. 1959. Exposure of longleaf pine planting stock. Jour. Forestry 57:825-827.
4. WAKELEY, PHILIP C. 1954. Planting the southern pines. Agric. Monograph No. 18. Forest Service, U. S. Dept. of Agric. pp 233. Illus.
5. ZEIGLER, E. A. 1915. Further notes on the exposure of white pine. Forest Quarterly 13:163-170.

Computing Growth from Increment Cores with Point Sampling

Albert R. Stage

POINT SAMPLING has several advantages as a method of selecting trees to be measured for increment. They result from the fact that trees are selected for sampling in proportion to their basal area. Growth studies have shown that basal area increments of trees in a stand are usually proportional to their basal areas.[1,2] Thus, with point sampling, trees are sampled approximately in proportion to their growth potential.

Conventional techniques of sampling basal area increment aim at determining the average increment per tree, or at establishing the curve of increment over diameter. The larger trees, on which most of the stand increment is placed, do not receive the attention due them. Therefore, disproportionate effort is spent sampling the smaller trees, which have only minor importance in establishing the increment of the stand. The technique of point sampling corrects this inequality if the sampling probability is given proper consideration in subsequent use of the data. Furthermore, the computation procedure itself is simple. Increment can be determined from point samples irrespective of how the stand data are determined—whether from conventional sample plots, a total stand tally, or from point samples.

Increment is determined in point sampling according to the following four steps:

1. Collect increment cores from the trees that qualify for tallying with a wedge-prism or any other convenient angle-gauge at several sampling points. The intensity of sampling depends on the homogeneity of the stand—a problem which will be considered in more detail in a later section.

2. Estimate the ratio of future gross basal area increment to present basal area according to the formula derived below.

3. Determine future net basal area increment by multiplying the ratio determined in step 2 by the present basal area of the trees expected to survive through the period. This procedure deducts mortality in terms of basal area rather than number of trees, and hence facilitates determination of mortality.

4. Convert basal area growth to volume growth by Spurr's "two-way" growth prediction method.[3]

Derivation of Formula

The basic unit of growing stock in point sampling is basal area rather than number of trees as in fixed-area plot sampling. Hence, for growth prediction purposes, it is desirable to relate growth directly to basal area. However, one must remember that whereas the denominator of a mean growth figure remains constant from one period to the next (assuming no mortality) when expressed as growth per tree, the denominator increases when expressed as growth per unit of basal area.

The following formula is analogous to one derived by Spurr[4] for estimating basal area increment by means of borings from trees sampled approximately proportional to their frequency. In common with most other techniques of stand projection this formula assumes that the increment of the future period will equal that of the past period. However, although diameter increment starts to decrease at an early age, basal area increment continues at a fairly constant rate throughout most of the rotation.[5] Therefore, this procedure is less likely to introduce errors in the growth prediction than the usual stand table projection assumption that the future diam-

THE AUTHOR is research forester, Inland Empire Research Center, Intermountain Forest and Range Expt. Sta., Forest Service, U. S. Dept. Agric., Spokane, Wash.

[1]Lynch, Donald W. Growth of young ponderosa pine in the Inland Empire. Intermountain Forest and Range Expt. Sta. Res. Paper 36. 16 pp. Illus. 1954.

[2]Gevorkiantz, S. R., and Lucille P. Olsen. An improved increment-core method for predicting growth of forest stands. Lake States Forest Expt. Sta. Paper 12. 19 pp. Illus. 1948.

[3]Spurr, Stephen H. Forest inventory. 476 + xii pp. Ronald Press Co., New York. 1952.

[4]Ibid.

[5]Baker, Frederick S. Theory and practice of silviculture. 502 + xiv pp. New York and London. 1934. See also: Spurr, op. cit.

eter increment will equal the past diameter increment.

The assumption of equal past and future basal area increment is expressed in the equality:

$$\frac{\text{Past B.A. Increment}}{\text{Present B.A.}} = \frac{\text{Future B.A. Increment}}{\text{Present B.A.}}$$

The ratio of past basal area increment inside bark to present basal area of a sample tree is given by the expression:

$$R_{ib} = \frac{D_{ib}^2 - d_{ib}^2}{D_{ob}^2}$$

where: D_{ob} = present diameter outside bark of an increment sample tree
D_{ib} = present diameter inside bark of an increment sample tree
d_{ib} = past diameter inside bark of an increment sample tree.

The increment including bark is obtained according to Spurr by multiplying by the factor:

$$\frac{D_{ob}^2}{D_{ib}^2}$$

which assumes that the bark percentage of total basal area remains constant. Thus the outside bark ratio becomes:

$$R_{ob} = \frac{D_{ib}^2 - d_{ib}^2}{D_{ob}^2} \times \frac{D_{ob}^2}{D_{ib}^2} = \frac{D_{ib}^2 - d_{ib}^2}{D_{ib}^2}.$$

Further computations are simplified by expressing this as:

$$R_{ob} = 1 - \frac{d_{ib}^2}{D_{ib}^2}.$$

The problem now is to arrive at a valid mean of $\frac{d_{ib}^2}{D_{ib}^2}$ applicable to the total stand basal area. Grosenbaugh[6] thoroughly discusses point sampling theory and application. The following equations are in accord with his treatment, but expressed for a specific purpose. When selected by an angle-gauge, all single-tree ratios apply to an equal number of square feet of stand basal area.[7] If at a point, n trees are sampled with a prism having a basal area factor of 25, present basal area per acre equals 25n. The past basal area would be:

$$25b_1 + 25b_2 \ldots 25b_n = 25\ (b_1 + b_2 + \ldots b_n)$$

where $b_1 = \frac{d_{ib}^2}{D_{ib}^2}$ of sample tree number 1, etc.

The appropriate average value, b_m is given by:

$$b_m = \frac{(b_1 + b_2 \ldots b_n)}{n} = \frac{\sum \frac{d_{ib}^2}{D_{ib}^2}}{n}.$$

Hence the average ratio of basal area increment to basal area per acre is:

$$R_{ob} = 1 - \frac{\sum \frac{d_{ib}^2}{D_{ib}^2}}{n}.$$

This can be simplified for computation to:

$$R_{ob} = 1 - \frac{\sum \left(\frac{d_{ib}}{D_{ib}}\right)^2}{n}.$$

Concerning the adequacy of the sample, the ratio is always correct if the distribution of number of trees in each diameter class of the sample corresponds to the basal area distribution of the entire stand (of which it is an unbiased estimate). Furthermore, in stands in which basal area increment is proportional to basal area, no error is introduced in the ratio even though the sample distribution does not truly coincide with that of the parent population. Thus the formula is valid for general use.

TABLE 1.—SAMPLE CALCULATION OF INCREMENT RATIO WITH POINT SAMPLING

Sample point	Increment data—10-year interval D_{ob}	D_{ib}[1]	d_{ib}	$\frac{d_{ib}}{D_{ib}}$	Sample point	D_{ob}	D_{ib}[1]	d_{ib}	$\frac{d_{ib}}{D_{ib}}$
1	12.6	11.4	10.4	0.912	3	6.0	5.6	5.3	0.946
	12.9	11.8	11.3	.958		6.7	6.2	5.9	.952
	12.3	11.2	10.3	.920		17.9	16.5	15.7	.952
	12.2	11.2	10.2	.911		11.4	10.4	9.5	.913
	11.5	10.7	10.0	.934	4	12.1	11.2	10.0	.902
	9.3	8.5	7.6	.894		8.6	8.0	7.0	.875
	9.3	8.2	7.9	.963		11.3	10.3	8.6	.835
2	10.1	9.3	8.2	.882		15.4	14.2	12.2	.859
	9.3	8.4	7.6	.905		11.4	10.5	9.0	.857
	7.0	6.4	6.0	.938		13.4	12.4	10.5	.847
	7.0	6.4	6.0	.938		13.6	12.5	11.2	.896
	7.2	6.5	5.7	.877					

$n = 23$ trees

$$\sum \left(\frac{d_{ib}}{D_{ib}}\right)^2 = 18.9607$$

$$R_{ob} = 1 - \frac{18.9607}{23} = 1 - .824 = .176$$

= 17.6 percent per decade gross basal area increment

[1] D_{ib} = D_{ob} minus double bark thickness.

Procedure

The sampling and computation procedures are illustrated by the following example taken from plots established as part of a growth and yield study of grand fir (*Abies grandis* Lindl.). Rectangular plots were laid out so as to include approximately 100 trees distributed uniformly over each plot. All the trees in the plot were tallied by 1-inch diameter classes. Point sampling locations were located on the plot diagonals one-fourth of their length in from the plot corners. Trees which qualified when a wedge-prism having a basal area factor of 25 was used were measured for diameter increment

[6] Grosenbaugh, L. R. Point-sampling and line sampling: probability theory, geometric implications, synthesis. Southern Forest Expt. Sta. Occ. Paper 160, 34 pp. Illus. 1958.

[7] Two exceptions to this statement should be noted: (1) "Slopover" factors for trees bordering a boundary, and (2) strongly elliptical trees are weighted differently. For appropriate corrections for these trees, see Grosenbaugh's treatment noted above.

and height at each of the four subsampling points. On small plots, a single large tree occasionally qualified from more than one point. For such trees, the diameter and radial increment on the side toward the sampling point were entered separately at each point. Only by tallying a tree at every point at which it qualified could the specification of sampling proportional to basal area be met.

The increment data for one plot are given in Table 1, and the necessary computations carried out below. The sum of squares of the increment ratios is conveniently computed and totaled on an automatic calculator. Note that the ratios of past diameter to present diameter are squared before adding.

Sample Size

Increment is usually determined by subsampling procedures. Basal area increment is thus subject to two components of error: (1) the error between plots in estimating basal area for the area as a whole, $(S.E.\%)_{BA}$ and (2) the error in determining the increment ratio $(S.E.\%)_R$. Assuming that these two components of error are independent:

$$(S.E.\%)_{BAI} = \sqrt{(S.E.\%)^2_{BA} + (S.E.\%)^2_R}.$$

The over-all design of a survey is established by the between-plot coefficient of variation of volume or basal area; the intensity of the subsample is determined by the within-plot variation of the trees on the principal plot. With proportional subsampling, the size of the subsample is expressed as a fraction of all the trees on the plot.

The study of grand fir yield gave the following data:

Mean basal area = 148.15 square feet per acre.

Coefficient of variation of basal area (between plots) $(C.V._{BA})$ = 26 percent.

Mean increment ratio = .235.

Coefficient of variation (within plots) of increment ratio[8] $(C.V._R)$ = 38 percent.

The number of observations needed to achieve a given error $(S.E.)$ is:

$$N = \frac{t^2(C.V.\%)^2}{(S.E.\%)^2}$$

with $t^2 = 3.84$ to yield about 95 percent probability of attaining the specified limits of error.

Solving this formula with the coefficients given above, for a $S.E.$ of 5 percent, 103.8 plots would be needed to estimate mean basal area per acre, and 221.8 trees to estimate the mean increment ratio.

For a survey with a prism having a basal area factor of 25 square feet per tree,

$$\frac{(148.5 \text{ sq. ft./acre})\ (103.8 \text{ plots})}{25 \text{ sq. ft./acre/tree}} = 615 \text{ trees}$$

will be tallied to obtain the basal area estimate. The sampling percent for increment equals: 222÷615 = 36 percent. Thus, a random selection of one tree out of every three trees counted at each point would be bored for increment.

Summary

The procedure of selecting trees with an angle-gauge for increment sampling has three distinct advantages:

1. The sampling effort is concentrated according to the growth potential of the stand rather than tree frequency. The field procedure is simple and objective.

2. The basal area increment per unit of basal area is readily computed by an objective procedure.

3. Mortality is deducted as basal area in predicting net increment rather than as number of trees—a more variable measure.

A formula for computing the ratio of increment to basal area which allows for changing bark thickness is presented. A procedure for estimating the fraction of trees to be bored at each plot is also outlined.

[8] In the grand fir plot data, the variation between the four subsampling points per plot was essentially zero. Hence, the data have been treated as though all trees had been selected from a single sampling point per plot.

Communications Association to Meet

The Eleventh Annual Conference of the Forestry, Conservation Communications Association will be held July 20-22 at the Hotel Duluth in Duluth, Minn.

Included in the agenda are technical talks and demonstrations by representatives of electronics manufacturers and discussion and clarification of the recent F.C.C. rule changes.

Girard Form Class Estimation from Lower Bole Measurements on Upland White Oak Trees in Missouri

Jack D. Harris and
Andrew J. Nash

IN RECENT YEARS a method of estimating Girard form class from measurements on the lower part of the tree bole has been under investigation. Burns and Adams (*1*) conducted research on pine stands in Louisiana, and Horn (*3*) applied lower measurements to loblolly and shortleaf pine in Mississippi. Both reports indicate that Girard form class can be estimated with reasonable accuracy by obtaining the ratio of measurements at two heights on the lower portion of the trunk. The advantage in applying their results is that a quick check on Girard form class can be obtained in the field without the necessity of using a ladder, climbing irons or other means of reaching the upper Girard form class measurements at 17.3 feet above ground. Since Girard form class has become a commonly accepted standard in estimating tree taper and many volume tables indicate taper in Girard form class units, it is obvious that there would be greater attention paid to Girard form class if measurements on the lower part of the tree gave a sufficiently accurate estimate of Girard form class. Because of the difficulty in obtaining the measurements at 17.3 feet, form class is usually estimated ocularly, or a single form class figure is applied to a number of stands. Both methods can lead to rather serious errors in estimating timber volume.

THE AUTHORS are forester, Georgia Kraft Co., formerly student at the School of Forestry, University of Missouri, and assistant professor of forestry, School of Forestry, University of Missouri, respectively.

Procedure

Two white oak stands located north of the Missouri River in Boone County, Mo., were selected as the test areas. In the selection of the stands, an even-aged condition and a wide spread of Girard form class were desired. The dominant and codominant trees in the stands were used in the test.

In obtaining the necessary field data, Girard form class was measured in the usual manner by taking diameter inside bark at 17.3 feet and diameter outside bark at 4.5 feet above ground, and obtaining the ratio of the former divided by the latter.

On each tree, diameter outside bark measurements were obtained at 6-inch intervals from 7 feet above ground to 1 foot above ground inclusive. A pole, marked at 6-inch intervals, was used to obtain the correct position on the trunk. Diameters at these points were then measured with a diameter tape. Bark thickness measurements were taken at one-foot intervals, and for each tree, a graph showing the relation between bark thickness in inches and diameter outside bark in inches permitted the plotting of diameter inside bark for each 6-inch interval on the lower portion of the bole.

A limited trial showed that the same numerical value as Girard form class would be obtained by the ratio of an upper diameter measurement in the vicinity of 6 feet above ground and a lower diameter measurement at approximately 2 feet above ground. Therefore the ratios were computed for lower measurements between one and 3 feet and for upper measurements between 6 and 7 feet. All possible combinations of "outside bark" and "inside bark" ratios were computed and entered in a specially designed tally sheet. A small number of trees of unusual form class were rejected from the data as being not representative of the population of trees sampled. The rejection was based on a standard procedure for rejection of abnormal data.

From the data sheets, the combinations of an upper and lower diameter measurement were examined to determine which two measurements came closest to the actual Girard form class. An arbitrary limit was set at one full form class above or below the actual form class of the tree.

Results and Conclusions

A tabulation of those combinations of upper and lower diameter within the range specified, showed that the ratio of an inside bark measurement 6.5 feet above ground to an outside bark measurement at 2.5 feet above ground fulfilled the specifications more often than any other combination of diameters.

Expressed mathematically, the ratio is:

$$\text{Estimated Girard form class} = \frac{dib_{6.5}}{dob_{2.5}}$$

In order to express the relation between form class obtained from lower bole measurements and ac-

tual Girard form class a regression equation was calculated by the least squares method.

A test of goodness of fit, as described by Snedecor (*4*), was applied to the data. The results indicated that the linear regression was highly significant. Goulden's (*2*) test of goodness of fit also supported this conclusion, indicating that the use of a straight line relationship is justified.

The distribution of the points and the regression line are shown in Figure 1.

The regression equation is $\hat{Y} = 12.44 + 0.841\ X$, where X is form class from lower bole measurements and Y is Girard form class. This relation allows us to estimate Girard form class by means of the two measurements on the lower portion of the tree. The standard error of estimate, or standard deviation from regression, is $\pm$ 3.17 Girard form class units.

The regression equation was used to calculate the estimated Girard form class which could be expected for unit values of the independent variable. The differences between the two, rounded off to the nearest whole number, are shown in Table 1.

The difference between form class from the lower measurements and actual Girard form class in the central portion of the table is quite low. When Girard form class of a tree is low—below F.C. 75—the lower bole method tends to underestimate form class, and over-estimate it when Girard form class is high. In terms of the lower measurement method being an estimator of Girard form class, the results are well within acceptable limits.

The application of the principle of using lower bole measurements to obtain form class would be less time-consuming if a combination of two *outside bark* measurements would have given satisfactory results. A test of various outside bark measurements was made but with unfavorable results; in less than 25 percent of the trees measured were the specifications of $\pm$ 1 Girard form class unit met. In order to use two outside bark measurements, it would have been necessary to take diameters higher than 7.0 feet above ground and this is beyond the reach of a man of normal height. The object of this study was to secure two lower measurements which could be made without having to use additional equipment.

Rather than compute the form class from the regression equation, tables showing estimated Girard form class for different combinations of upper and lower measurements can be made. The upper measurement is inside bark and the lower, outside bark. These will serve as a field guide in obtaining a good estimate of Girard form class from these two measurements. To be of most value, a table for field use should show the form class expected for every 0.2 inch increase in both upper and lower measurement. Table 2 shows the Girard form class which can be expected for 0.5 inch increases in both dib at 6.5 feet and dob at 2.5 feet. Interpolation in the field will give form class for those diameters falling between the ones shown in the table.

Some problems and difficulties in the work should be mentioned. Trees which have pronounced butt swell result in a very low estimated form class. White oaks grown in reasonably dense stands do not exhibit this undesirable characteristic frequently, although there is a possibility of obtaining misleading form class information by measuring such trees.

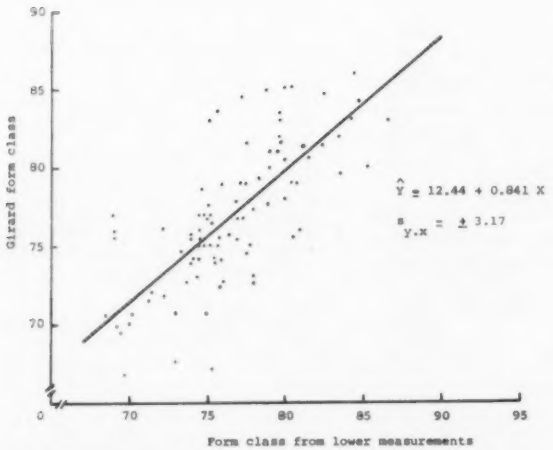


FIG. 1.—Regression of Girard form class on form class obtained from lower bole measurements.

TABLE 1.—COMPARISON BETWEEN FORM CLASS FROM LOWER BOLE MEASUREMENTS AND GIRARD FORM CLASS FROM THE EQUATION $\hat{y} = 12.44 + 0.841\ x$

(1) Form class from lower measurements	(2) Girard form class	(1)—(2) Difference
65	67	— 2
66	68	— 2
67	69	— 2
68	70	— 2
69	70	— 1
70	71	— 1
71	72	— 1
72	73	— 1
73	74	— 1
74	75	— 1
75	75	0
76	76	0
77	77	0
78	78	0
79	79	0
80	80	0
81	80	+ 1
82	81	+ 1
83	82	+ 1
84	83	+ 1
85	84	+ 1

TABLE 2.—ESTIMATED GIRARD FORM CLASS FROM THE RATIO OF DIB AT 6.5 FT. TO DOB AT 2.5 FT.

Dib at 6.5 ft.	Diameter outside bark at 2.5 ft., inches														
Inches	7.0	7.5	8.0	8.5	9.0	9.5	10.0	10.5	11.0	11.5	12.0	12.5	13.0	13.5	14.0
	Estimated Girard form class														
6.0	86	80	75	71	67	63	60								
6.5		87	81	76	72	68	65								
7.0			88	82	78	74	70	67	64	61					
7.5				88	83	79	75	71	68	65	62				
8.0					89	84	80	76	73	70	67	64	61		
8.5						90	85	81	77	74	71	68	65		
9.0							90	86	82	78	75	72	69	67	64
9.5								90	86	82	78	75	73	69	67

	Diameter outside bark at 2.5 ft., inches																	
	11.0	11.5	12.0	12.5	13.0	13.5	14.0	14.5	15.0	15.5	16.0	16.5	17.0	17.5	18.0	18.5	19.0	19.5
	Estimated Girard form class																	
10.0	91	87	83	80	77	74	71	69	67	65	62							
10.5		91	87	84	81	78	75	72	70	68	66	64						
11.0				88	85	81	79	76	73	71	69	67	65	63				
11.5					88	85	82	79	77	74	72	70	68	65	64			
12.0							86	83	80	77	75	73	70	68	67	65		
12.5								86	83	81	78	76	73	71	69	67	66	64
13.0									87	84	81	79	76	74	72	70	68	67
13.5											84	82	79	77	75	73	71	69

	Diameter outside bark at 2.5 ft., inches																	
	16.5	17.0	17.5	18.0	18.5	19.0	19.5	20.0	20.5	21.0	21.5	22.0	22.5	23.0	23.5	24.0	24.5	25.0	25.5
	Estimated Girard form class																	
14.0	85	82	80	78	76	74	72	70	68	67	65							
14.5		85	83	80	78	76	74	72	70	69	67	66						
15.0				83	81	79	77	75	73	71	70	68	67	65				
15.5						81	79	77	75	74	72	70	69	67				
16.0						85	82	80	78	76	74	73	71	69	68	67	65	
16.5							85	82	80	78	77	75	73	72	70	69	67	66	65
17.0								85	83	81	79	77	75	74	72	71	69	68	67
17.5									85	83	81	80	78	76	75	73	71	70	69

Unlike loblolly and shortleaf pine on which previous work was done, oaks occasionally produce a crown whose lower branches start within 20 feet of the ground. This will affect the actual Girard form class, resulting in a high value due to the swelling of the trunk at the base of the lower limbs. These extremes in taper should be avoided, if possible. More reliable estimates of Girard form class will result if dominant and codominant trees are selected for lower bole measurements.

Summary

Estimated Girard form class from two measurements on the lower portion of the tree was tested in two white oak stands in central Missouri. From a number of different combinations of inside and outside bark measurements at various heights above ground, it was found that the best combination was obtained from an inside-bark measurement at 6.5 feet above ground and an outside-barks measurement at 2.5 feet above ground. The estimated Girard form class can be obtained from the linear equation $\hat{Y} = 12.44 + 0.841\ X$, in which X is from class obtained from the two lower measurements and Y is Girard form class.

Individual tree characteristics such as butt swell and short boles may cause wide variations in the relation between the two methods of obtaining form class, but the difference is very low if dominant and codominant trees in reasonably well-stocked stands are measured.

Literature Cited

1. BURNS, P. Y., and R. J. ADAMS. 1956. Girard form class can be estimated from lower bole taper. LSU Forestry Note No. 8.
2. GOULDEN, CYRIL H. 1952. Methods of statistical analysis. John Wiley and Sons, Inc. New York.
3. HORN, A. G. 1956. A simplified method for estimating form class of loblolly and shortleaf pine in Mississippi. Jour. For. 54:185-187.
4. SNEDECOR, GEORGE W. 1957. Statistical methods. The Iowa State University Press, Ames, Iowa.

A Study of Consumer Preference in Christmas Trees[1]

D. P. Duncan, E. T. Sullivan,
C. J. Shiue, and R. I. Beazley

THIS STUDY of consumer preference in Christmas trees was undertaken to guide growers, wholesalers, and retailers who supply two kinds of metropolitan Twin City markets in Minnesota. In addition, the study has implications nationally with respect to grades. It permitted two consumer market populations an opportunity to express choice as to trees under designed circumstances where many controlled alternatives were available free of the biasing effect of price, display, and a lack of trees in many categories. Problems of importance to those operating in these markets were raised, such as: What species and size classes are preferred? Do these preferences vary with consumer characteristics (such as income class, occupation, sex, age, etc.)? Do density and taper preferences indicate that sheared trees should be placed on the market?

Scope and Method of Study

Two commercial Christmas tree lots were selected for the study, one in a residential-commercial district within Minneapolis, the other in Hopkins, a suburb of Minneapolis. The customers interviewed were systematically selected from among the regular customers entering the lot. Interviews were conducted continuously during the time that the lots were open, beginning on the day they opened and extending through Sunday, three days before Christmas of 1957.

A display of trees of various kinds designed to permit comparison and unbiased choice was set up at the two locations, each including two groups of trees, all of which were free of noticeable defect. Trees within both groups were randomly arranged as to proximity within the design and were similarly randomly rearranged through time. The first group contained three height classes of trees, 3 to 4 feet, 5 to 7 feet, and 9 to 12 feet for each of seven species: balsam fir; red pine; white pine; Scotch pine; white spruce; black spruce; and Norway spruce. Except for large black spruce which was not available, all of the 21 combinations of species and height were displayed for examination by interviewees.

The second group of trees was medium in height (5 to 7 feet) and had various combinations of nee-

TABLE 1.—NUMBER AND PERCENT OF FIRST CHOICES BY SPECIES AND SIZE CLASSES AT TWO LOTS

Height class	Balsam fir	Red pine	White pine	Scotch pine	Black spruce	White spruce	Norway spruce	Percent
Feet			City Lot n=286					
3-4	16	3	2	4	4	0	3	11
5-7	89	18	7	15	12	10	24	61
9-12	64	2	0	5	—	7	1	28
Percent	59	8	3	8	6	6	10	100
			Suburban Lot n=74					
3-4	0	0	0	0	0	1	0	1
5-7	30	9	1	17	1	2	4	87
9-12	2	1	1	0	—	3	2	12
Percent	43	14	3	23	1	5	8	100

TABLE 2.—NUMBER AND PERCENT OF FIRST CHOICES OF SPECIES BY INCOME CLASSES AT TWO LOTS

Income class	Balsam fir		3 pines		3 spruces		All species
	Number	Percent	Number	Percent	Number	Percent	
Dollars per year			City Lot n=286				*Percent*
Below 5,000	63	59	20	19	24	22	37
5,000 to 7,499	62	56	24	22	25	22	39
7,500 and over	44	55	12	18	12	17	24
All incomes	169	59	56	20	61	21	100
			Suburban Lot n=74				
Below 5,000	0	0	1	50	1	50	3
5,000 to 7,499	14	50	9	32	5	18	38
7,500 and over	18	41	19	43	7	16	59
All incomes	32	43	29	39	13	18	100

THE AUTHORS are faculty members or former faculty members of the School of Forestry, University of Minnesota, St. Paul.

[1]Published as Scientific Journal Series Paper No. 4191 of the Minnesota Agric. Expt. Sta. This project was supported in part by the North Central Regional Project, NCM-20.

dle density (classed as sparse, medium, or dense) and tree taper (classed as candlestick, normal, or flaring). As shown in Figure 1, density and taper classes were consistent within species. At the city lot, balsam fir, red pine, white pine, white spruce, and black spruce were displayed in these combinations, giving an expected total of 45 trees. Actually it was not possible to fill all density-taper cells for all species, but six to eight of the nine possible cells were filled for each which finally accounted for 34 trees. At the suburban lot, a deficiency of trees for these cells and a relatively small number of customers resulted in discarding the density-taper data as insufficient for analysis.

Only customers selecting trees for their own home were included. They were asked to make the assumption that "price is unimportant" in order to eliminate price as a consideration affecting preference. Each interviewee was first taken to the species-size grouping and asked to indicate his first, second, and third preference among the 20 trees displayed. He was then taken to the density-taper group of his first choice species and asked to express his preference among the six to eight trees displayed. If the species of his first choice was not available in the density-taper group, he was shown his second choice species for preference expression.

In addition to tree preferences for each interviewee, data were obtained on number of well formed faces desired (2, 3 or 4), proposed location of his tree at home, whether or not others affected his expressed preference, type of home (whether house or apartment), who resided in the home with him, occupation of the head-of-the-house, income class, age class, and sex.

The number of customers on each lot was recorded at half hour intervals throughout each day during which interviews were conducted to determine the distribution of customers in time. The city lot, for which the data were fully analyzed, was manned from 9:00 a.m. to 10:00 p.m.

Chi^2 tests were used in all analyses.

Results

Differences existed in preference between the consumers on the two lots. At the city lot, balsam fir received a higher preference rating than in the suburban lot, whereas pines, particularly Scotch pine, rated higher at the suburban lot than in the city lot (Table 1). Table 1 also shows differences between the two lots in size preference, the suburban consumer showing a much greater preference for medium size trees than the city consumer. The aggregate differences between lots proved to be significant at the 5 percent level.

On the city lot, the most popular tree characterized by species and height, was medium balsam fir while a fairly close second was tall balsam fir; third in popularity was medium Norway spruce, closely followed by medium red pine. In the suburban lot, medium balsam fir also was most popular, but medium Scotch pine was definitely second, with medium red pine third.

The total annual income for the family was appreciably higher at the suburban lot than at the city lot. Although income levels were stratified at the time of interview into $2,500 classes between "less than $2,500" and "$12,500 and over," for purposes of analysis only three classes were used (Table 2). Within lots, income class did not relate to species selection significantly above the 25 percent level. The very small percentage of people in the lower income class at the suburban lot invalidates its comparison with the other two income groups.

Since a relatively small sample was obtained at the suburban lot, the following analyses are concerned only with the sample obtained at the city lot. At this lot,

TABLE 3.—PERCENT OF CITY LOT CUSTOMERS PREFERRING SPECIES AS FIRST CHOICE AMONG THE GROUP OF 20 AND AS SECOND CHOICE IN THE SAME GROUP

	Balsam	Red pine	White pine	Scotch pine	Black spruce	White spruce	Norway spruce	Number of customers
1st (20 trees)	59	8	3	8	6	6	10	286
2nd (20 trees)	29	12	9	12	6	15	17	283[1]

[1]Three incomplete interviews.

TABLE 4.—FIRST CHOICE SPECIES PREFERENCE AT CITY LOT AS RELATED TO SEVERAL VARIABLES OF CUSTOMER CLASSIFICATION

Classification	Balsam	Pine	Spruce	All species		Significance level, Chi^2 [1]
	Percent	*Percent*	*Percent*	*Number*	*Percent*	
A—Influenced	66	18	16	161	56	1%
Not influenced	50	22	28	125	44	
B—House	62	20	18	193	68	8%
Apartment	51	20	29	90	32	
C—Children	60	15	25	179	63	1%
No children	57	27	16	107	37	
D—Under 30 yrs.	55	20	25	104	36	N.S.[2]
30 to 50 yrs.	63	17	20	144	51	
Over 50 yrs.	58	26	16	38	13	
E—Male	57	19	24	207	72	7%
Female	64	22	14	79	28	
F[3]—Craftsmen & foremen	59	19	22	59	21½	1%
Clerical, sales	70	20	10	51	18½	
Professionals, semi-professionals	43	37	20	49	18	
Operatives	61	17	22	36	13	
Proprietors, managers, officials	79	0	21	24	9	
College students	48	17	35	23	8½	
Others	55	19	26	31	11½	

[1]The hypothesis tested here is that there are no statistical differences vertically between or among the figures within classifications.
[2]Not significant above the 25 percent level.
[3]Census classifications.

of those customers choosing species other than balsam fir as first choice (41 percent), nearly half would have chosen balsam next (Table 3). In other words, over three quarters could have chosen balsam fir as their first and/or second choice species.

Table 4 provides a summary of the findings on the city lot relating species (grouped into pines, spruces, and balsam) preferences to several variables of classification of the customer. Preferences differ significantly at the one percent level among occupational classes, between those with children and those without, and between those influenced by others in the household and those not so influenced. The most striking difference in occupational classes is between professionals and proprietors with nearly as many of the former preferring pines as balsam; among proprietors, a very high proportion chose balsam, none expressing preference for pines. Possibly professionals are inclined toward greater flexibility of taste over time. Those having no children are more likely to choose pine than people with children. Perhaps people influenced by instructions from home are sometimes told: "Don't come home without a balsam." There is also evidence that more men are likely to choose spruce than women, and that more house dwellers choose balsam than apartment dwellers.

Similar comparisons were made by these variables of customer classification with respect to tree size preference (Table 5). A significant difference at the 5 percent level was found between sexes and among age classes. Women are more likely to prefer small trees than men, whereas older people show a higher preference for medium size trees than younger people.

The data relating to taper and density preferences on the city lot (Tables 6 and 7 and Fig. 1) indicate highly significant preferences among the customers interviewed. Dense trees having flaring form were most popular. The notable exception is in black spruce where

TABLE 5.—FIRST CHOICES BY SIZE CLASS AT CITY LOT AS RELATED TO SEVERAL VARIABLES OF CUSTOMER CLASSIFICATION

Classification	Small	Medium	Large	All Sizes		Significance level, Chi²[1]
	Percent	*Percent*	*Percent*	*Number*	*Percent*	
A—Influenced	10	61½	28½	161	56½	N.S.[2]
Not influenced	13	61	26	125	43½	
B—House	10	62	28	196	68½	N.S.[2]
Apartment	13½	60	26½	90	31½	
C—Children	15	63½	21½	107	37⅓	10%
No children	9	60	31	179	62½	
D—Under 30 yrs.	17	58	25	104	36½	5%
30 to 50 yrs	6	60½	33½	144	50½	
Over 50 yrs.	13	74	13	38	13	
E—Male	7½	63½	29	207	72½	5%
Female	20	56	24	79	27½	
F[3]—Craftsmen, foremen	3½	74½	22	59	22	
Clerical, sales	13½	65	21½	51	18½	20%
Professionals, semi-professionals	8	63½	28½	49	18	
Operatives	11	61	28	36	13	
Proprietors, managers, officials	8	42	50	24	8½	
College students	17½	52	30½	23	8½	
Others	22½	48½	29	31	11½	
Up to $5000/annum	14	62	24	107	37	20%
$5000 to $7499/annum	10½	65	24½	111	39	
$7500 over/annum	7	55	38	68	24	

[1]The hypothesis tested here is that there are no statistical differences vertically between or among the figures within classifications.
[2]Not significant above the 25 percent level.
[3]Census classifications.

TABLE 6.—TAPER-DENSITY FIRST CHOICES BY SPECIES AT THE CITY LOT

	Percentage of customers					
	Balsam fir	Red pine	White pine	Black spruce	White spruce	All species
Taper Class						
Candlestick	4	6	15	55	0	6
Normal	46[2]	9	21[2]	36	21	37[2]
Flaring	50[1]	95[2]	54[1]	9	79	57[1]
Taper class total	100	100	100	100	100	100
Density class						
Sparse	13[1]	0	8	0	0	9[1]
Medium	18[1]	17	31	45	42	22[1]
Dense	69[2]	83	61	55	58	69[2]
Density class total	100	100	100	100	100	100
Number of customers Basis	193	35	13	11	33	285

[1]This figure is probably an important underestimate because of missing cells (see Table 7).
[2]This figure is probably an important overestimate because of missing cells (see Table 7).

TABLE 7.—RELATION BETWEEN TAPER AND DENSITY FIRST CHOICES BY SPECIES AT THE CITY LOT. NUMBER OF CUSTOMERS

Taper	Density	Balsam fir	Red pine	White pine	Black spruce	White spruce	Total
Candlestick	Sparse	5	×	0	×	×	5
	Medium	0	2	2	3	0	7
	Dense	2	×	×	3	0	5
Normal	Sparse	20	0	1	×	0	21
	Medium	35	3	2	2	2	44
	Dense	33	×	1	2	5	41
Flaring	Sparse	×	0	×	0	0	0
	Medium	×	1	×	0	12	13
	Dense	98	29	7	1	14	149
Total		193	35	13	11	33	285

× = unfilled cell

FIG. 1.—Density and taper classes displayed as illustrated by balsam fir in the normal and candlestick classes and white spruce in the flaring classes.

Dense flaring spruce	Dense normal fir	Dense candlestick fir
Medium flaring spruce	Medium normal fir	Medium candlestick fir
Sparse flaring spruce	Sparse normal fir	Sparse candlestick fir

flaring trees are given lowest rank and where dense trees have been given little preference over medium density. The sample here, however, is small.

The interaction between taper and species, and density and taper are significant at the one percent level while the interaction between density and species is also significant but at the five percent level. As first choice in balsam fir, for example, if the trees are dense, a flaring form is preferred; if the trees have a candlestick form, sparse density is preferred.

More than half (57 percent) of the customers wanted a tree with three good faces. Thirty-six percent wanted four good faces and seven percent wanted only two good faces. Slightly over 95 percent of the customers at the city lot studied wanted only one tree and 91 percent expected to place their tree in the living room.

It is apparent from the distribution of customers by day and date (Fig. 2) that a large number bought their trees on the two weekends prior to Christmas (which fell on a Wednesday). On Saturdays, customers appeared in considerable numbers between 11:00 a.m. and 6:00 p.m. whereas on weekdays, most customers appeared between 3:00 and 9:30 p.m. (Fig. 3).

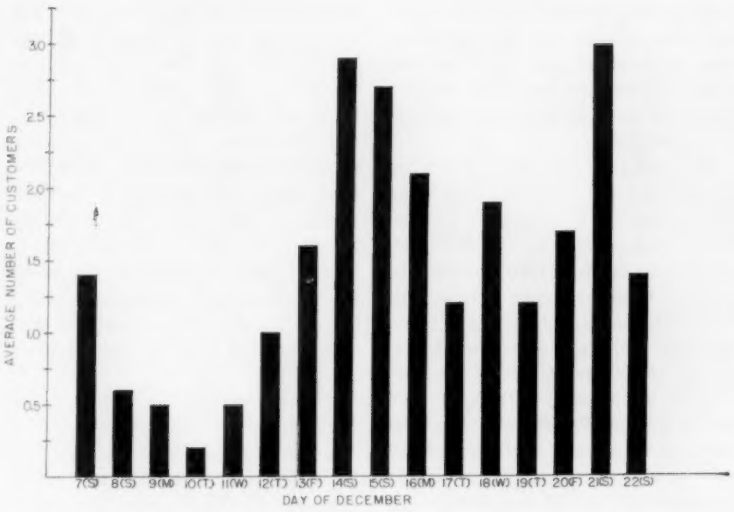


FIG. 2.—Distribution of customers in the city lot by day and date. Vertical axis shows average number of customers on the lot at a given time. Data taken on the hour and half hour from 9:00 a.m. to 10:00 p.m.

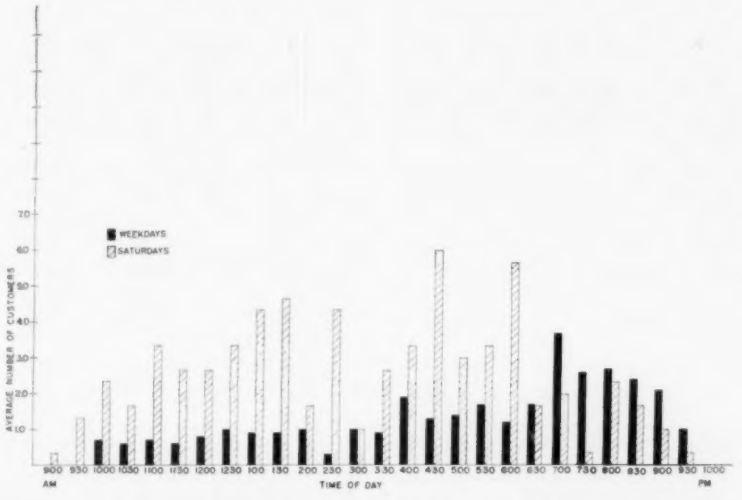


FIG. 3.—Distribution of customers by hours of day on Saturdays and on weekdays (excluding Saturdays and Sundays).

Conclusions

This study, limited to two Twin City lots and therefore restricted in many of its applications, indicates a distinct preference among consumers for balsam fir as a Christmas tree.

It is possible that more consumers would have discriminated against spruce than did so had they recognized the fact that unwatered spruces tend to drop needles early, and that the tree they had selected was a spruce. In the long run, this characteristic may be reflected in customer satisfaction and their continued patronage of a particular lot regularly handling a high proportion of spruce. An experiment undertaken to ascertain amount of needle fall in spruce indicates, however, that watered trees (in which at least four inches of the stem was removed at the base before placing them in water) dropped only 1½ percent of their needles in the first two weeks of exposure in a heated room.

The preference among consumers on the lot studied for high density trees implies a need for shearing, debudding, or both, at least among pines to be marketed for Christmas trees. This agrees with the findings of Haeskaylo[2] with respect to preferences for Scotch pine in Ohio, where heavily sheared trees were preferred. The pines having greatest density in the present study were, without exception, sheared or debudded. Among the spruces and fir, open grown plantation

[2]Haeseaylo, John. Consumer preference in Scotch pine as a Christmas tree. Ohio Agric. Expt. Sta. Forestry Mimeo. No. 31. 1956.

trees having a relatively wide spacing and grown on fine-textured soils most often provided the desired characteristics. None of the spruce or fir trees had been sheared or debudded.

The findings indicate a need for reconsideration of taper classes as they affect U. S. standard grades[3] for Christmas trees. Whereas, according to the published standards, flaring taper reduces grade, the data obtained in this study, when unfilled cells are considered, indicate that flaring trees are preferred, at least for balsam and white spruce. Flaring red pine was selected by a very high proportion of customers but is heavily weighted by the fact that the only dense red pine available was flaring. Also on the basis of expressed preference at the city lot studied, no degrade is necessary for trees having three instead of four faces since most customers preferred the former. There is reason to doubt whether many people indicating preference for four faces at the lot would, in fact, discriminate against a tree with three faces when set up in their home.

Information obtained on consumer characteristics indicates that these are related to preferences. A lot owner, for example, might well give consideration to certain characteristics of his clientele in deciding the kinds of trees he might sell most successfully, and therefore the kind he should place on his lot.

In this study, no attempt has been made to ascertain price differentials which might be assigned as a result of the expressed preferences of the customers interviewed. Acceptance, where price enters the question, may be different than preference.

It is incorrect to assume that, because there are no significant differences between first choice frequency for red pine (8 percent at the city lot) and that for white spruce (6 percent at the city lot), there is no preference between the two. The preferences indicated may be very strongly held by the individuals concerned. It would be unwise for a lot owner to stock only balsam fir on the grounds that most people prefer this species since he would undoubtedly lose many customers who want pine, for example.

Consumer preference is subject to change, and species selection for a particular plantation may be governed more by site conditions than by consumer preference. It seems probable, however, that preference will change materially only as new species or techniques provide more attractive qualities or as the circumstances in which trees are used change. Certainly, a Christmas tree currently preferred by most consumers should be grown in proportionately larger numbers for maximum consumer satisfaction, other considerations being equal. Consumer preferences have even more immediate application to wild trees where current preferences can be reflected immediately in harvest cuts.

[3]U.S.D.A., Agric. Mkt. Serv. United States standards for Christmas trees. 22 F.R. 7767. 1957.

Addendum

In commenting on my "Notes on Cruising Intensity by the Bitterlich Method" (Nov., 1959 JOURNAL, page 849) J. L. Clutter of the Southeastern Forest Experiment Station points out that

$$\text{Exp (e)} \neq \text{Exp}\left(\frac{C}{N}\sum_{j=i}^{n}\right) K_j$$

Then it can be proved that the cruising intensity is given by

$$\text{Exp (p)} = \frac{10n}{A'}\, b^*$$

$$\text{Where } b^* = \frac{\sum_{i=1}^{n} b_i^2}{\sum_{j=1}^{n} b_i} = \text{weighted average basal}$$

area per tree, the weight for each tree being the basal area itself.

TIBERIUS CUNIA
Canadian International Paper Co.,
Montreal, Canada

A Cone Production Study in Loblolly Pine on The Coastal Plain of North Carolina[1]

Eyvind Thorbjornsen

IN THE PAST few years foresters have become increasingly interested in the cone-producing ability of stands and individual trees. This interest is mainly due to an awareness of the large amounts of seed required both for natural regeneration and for forest tree nurseries. With a shift in the emphasis from lumber to pulp in the South, there is also a tendency for shorter rotations and a resulting decrease in cone production. The effect of such a trend could be serious; but a large number of the pulp companies are meeting this challenge by means of their forest genetics programs. They plan to produce the bulk of their seed in seed-production areas and in seed orchards. This growing application of forest genetics has further stimulated the need for knowledge about cone production.

In an attempt to delimit the factors that cause a pine tree to be a superior or inferior cone producer, a study on loblolly pine (*Pinus taeda* L.) was initiated in 1957 and continued in 1958. This work was done in five locations in North Carolina: Jacksonville, New Bern, Washington, Bethel, and Ahoskie. All five study areas are on the Coastal Plain on lands of the North Carolina Pulp Company, Division of Weyerhaeuser.

In each area three to six selected trees were used, each of which had previously been graded for seed orchard establishment in the North Carolina State-Industry Cooperative Forest Tree Improvement Program. Data were also taken from three other dominant trees near each selected tree for purposes of comparison. In all, a total of 71 trees were climbed and studied in 1957 and 60 in 1958. Eleven trees included in the 1957 study were not used in 1958, either because they were cut, mutilated by previous scion collection or inaccessible due to the destruction of a bridge.

All the trees in this study were climbed by means of the Swedish ladder so that accurate data could be obtained. The total length of the live crown was measured to the nearest foot and divided into three "working areas," the top quarter, next-to-top quarter, and lower half. In each working area, branch diameters were measured one foot from the bole and the limb lengths were obtained with a graduated pole. Counts were made of the number of main side branches and short branches on one branch in each working area. Old cones (which had released the seed the preceding fall and winter, or in earlier years) and new cones (which would mature the coming fall) were counted for each of the three working areas.

The sites on which the selected trees were growing were relatively uniform. According to Coile's tables (*1*) and from actual measurements of tree heights, the lowest site index encountered was 75 and the highest was 100. The topsoil varied from a silty loam to a clay loam, and was underlain by clay loam, clay, or heavy clay. Depth of topsoil averaged 10 inches, but varied from 6 to 36 inches. The average pH was 4.5, ranging from 4.1 to 5.1, and organic matter amounted to 3.1 percent ± 1.8 percent. Available calcium, potas-

TABLE 1.—COMPARISON OF CONE PRODUCTION OF SUPERIOR LOBLOLLY PINES AND CHECK TREES

Tree no.	No. of cones, 1957		No. of cones, 1958	
	Superior tree	Av. check tree	Superior tree	Av. check tree
1	2	6	3	6
2	0	20	41	372
3	0	3	0	12
4	46	10	116	51
5	5	10	164	58
6	4	45	——no data——	
7	3	108	16	74
8	90	19	67	16
9	84	37	109	61
10	11	22	68	35
11	47	10	——no data——	
12	15	14	86	96
13	77	87	——no data——	
14	76	107	——no data——	
15	18	11	164	143
16	68	44	——no data——	
17	4	23	10	72
18	9	14	30	46
19	9	13	8	53
20	84	34	——no data——	

THE AUTHOR is forest geneticist, Agric. Expt. Sta., University of Tennessee, Knoxville.

[1]Contribution from the School of Forestry, N. C. Agricultural Experiment Station, Raleigh, N. C. Published with the approval of the director of research as Paper No. 1039 of the Journal Series.

sium, phosphorus, and magnesium were low. The phosphorus was especially low, varying from zero to two parts per million.

Cone Production of Superior or Plus Trees

One objection to the genetic selection program has been that it tends to place a premium on trees with narrow crowns and small branches, seemingly resulting in the selection of trees which are inferior seed producers. Low seed producers would be definitely undesirable in a seed orchard. Lindquist (*6*) found that a large number of selected Scotch pines with narrow crowns had the ability to produce heavy cone crops, while on the other hand some good phenotypes had to be discarded due to apparent sterility.

This study showed that cone yields of superior trees are not substantially different from those of ordinary crop trees (Table 1). In 1957 eight of the plus trees were superior and 12 were inferior cone producers, while in 1958 six were superior and eight inferior. These differences are not significant, thus indicating that the plus trees are probably as good cone producers as the other dominant trees in a stand, despite their selection for acceptable crown size and shape. There is no evidence that any of the plus trees are sterile. Those few trees that produced few or no cones in both years were relatively young, being about 30 years old. Also, they were growing under heavy competition with neighboring trees so that their crowns were extremely crowded.

TABLE 2.—CORRELATION COEFFICIENTS FOR CONE PRODUCTION AND STEM MEASUREMENTS

Variable	Sample correlation coefficient (r)
Diameter breast height	0.593***
Total height	0.361**
Stem volume	0.554***

**Significant at the 1 percent level.
***Significant at the 0.1 percent level.

Annual Variation In Cone Production

A number of environmental factors may cause the large annual variation in cone production so clearly evident in loblolly pine. Wenger (*10*) found a direct relationship between cone production and the May-to-July rainfall of the second preceding year. Neither the effect nor the relative importance of these factors is fully understood. Evidently, cone production must be observed for more than one year to be evaluated with much accuracy.

The 1957 cone crop was generally rather poor; the 1958 crop could be characterized as moderately good (Table 1), but there were exceptions. In the area farthest north, near Ahoskie, both seed years were quite poor. Only 15 of the 60 trees which were climbed both years had the better crop in 1957; nine of these 15 trees were located in the Ahoskie area.

No trees behaved contrary to the general trend. Even though there was considerable variation from one year to the next, no single tree had a good crop in the same year the stand had a poor crop, or vice versa.

Effect of Tree Size

Several workers (*2, 5, 7, 9, 11*) have found a relationship between fruitfulness and diameter at breast height of the tree. It has also been suggested that height may influence cone production.

Many of the past studies on cone production have had limited accuracy because the cones were counted with the aid of binoculars. The author frequently observed differences of more than 50 percent between ground-binocular estimates and actual cone counts. Errors stemming from ground counts make it impossible to develop reliable correlations between fecundity levels and various independent variables.

The correlation coefficient is a valuable figure in cone production studies; it measures the degree of association between two variables, such as d.b.h. and number of cones. This study showed that size of tree, regardless of how expressed, was significantly related to the average number of cones produced in 1957 and 1958 (Table 2).

The association between d.b.h. or volume and cone production is very highly significant and suggests that about a third of the

TABLE 3.—VOLUME OF LOBLOLLY PINE BRANCHES IN $\frac{1}{100}$ CUBIC FOOT

Branch length in feet	.6	.7	.8	.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3
18																			410	438	468	500	536	571	607			
17																			325	347	370	395	423	453	485	519	554	590
16																		291	312	334	356	380	408	438	470	503	538	575
15															218	234	258	278	298	319	340	363	390	420	451	483	520	
14														189	203	218	237	259	281	302	324	347	373	402	433	467	503	
13											138	150	162	175	188	202	218	238	259	280	302	326	352	382	415	451	487	
12									104	116	127	138	150	162	174	187	202	219	239	260	282	305	331	361	396	433	470	
11									94	105	116	127	138	149	161	173	189	205	222	242	263	286	311	340	376	414	454	
10									83	94	105	116	127	138	150	163	178	193	210	228	247	269	292					
9							56	64	73	84	95	107	118	130	143	155	169	183	199	216	234							
8						43	50	58	66	76	87	98	110	122	135	148	160	174	189	205	222							
7					33	38	46	53	61	70	80	91	102	114	127	140	153											
6					30	35	42	49	57	64	73	84	95															
5			20	23	28	32	38	44	52	60																		
4	12	14	17	21	25	30	35																					
3	10	12	14	17	21	25																						

Branch diameter in inches one foot from bole

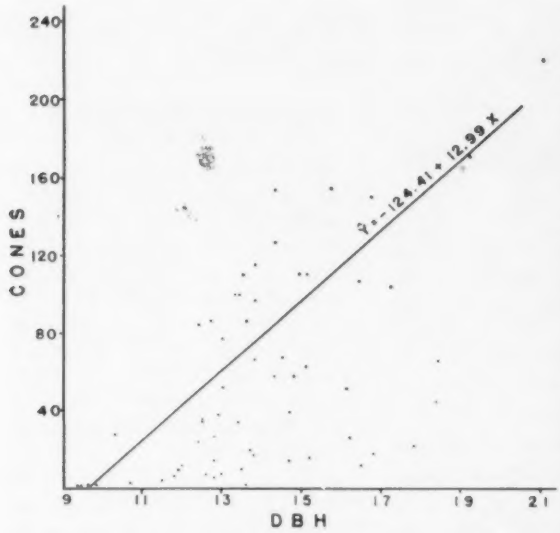


FIG. 1.—Sample regression of number of mature cones on d.b.h. in inches.

FIG. 2.—The plus tree (white band) has a branch volume of only 4.3 cubic feet against 6.9 cubic feet for the average check tree. The edge tree to the left has a branch volume of almost 14 cubic feet.

variation in cone production is accounted for by either of these variables. Total tree height, although associated to a highly significant degree with cone-producing ability, accounts for only slightly more than 10 percent of the variation in fecundity. It is very fortunate that d.b.h., which is so easy to measure, is one of the better indicators of cone-producing capacity. However, variation among individual trees is large, as is well illustrated by Figure 1.

Crown Characteristics and Cone Production

Pomeroy (*7*) states that crown development does not provide a consistent index of future cone production. However, Grano (*5*) reports a relationship between cone count and crown volume that was better than the relationship between cone production and tree diameter. Goddard (*3*) observed in a seed production area that the trees with large crowns were not necessarily the heaviest cone producers.

Previous results of such studies have usually been based on subjective estimates alone, rather than on actual measurements. In an attempt to bring more light to the relationship between crown and cone production, a rather intensive study was made of certain crown characteristics.

To make the intensive study of the crown, a volume table for loblolly pine branches needed to be developed. A total of 187 branches from eight trees were measured for length, and also for diameter at a distance of one foot from the bole. Each branch was cut up into small sections, the volumes determined by water displacement, and the resultant data assembled into a volume table (Table 3).

Even though no trees with abnormal crowns (i.e., wolf trees or suppressed trees) were included among the 71 trees climbed, considerable variation in branch volume was found. Some of the plus trees having large bole volume had relatively small crowns (Fig. 2).

The sample correlation coefficient between branch volume and cone production was 0.529 (Table 4). However, it appears from Figure 3 that the relationship is not strictly linear, yield of cones becoming constant rather abruptly at a branch volume of approximately four cubic feet. A curvilinear regression equation $\hat{Y} = -13.62 + 17.28X - 0.45X^2$ fitted the data better than the linear regression equation.

There has been some speculations (*7*, *11*) whether the length of crown, or the crown length: tree length ratio, provides a good estimate of cone crops. This study indicated rather clearly that the ratio has no predictive value for loblolly pine (Table 4).

However, the absolute length of the crown is highly correlated with cone production, even though it accounts for less than 15 percent

of the variation in degree of fruitfulness.

Position of Cones in the Crown

On the individual branches there are short branches which are several times as numerous as the main branch tips and the main side branches. However, these short branches supported only 13 percent of the cones. The tips of the main branches supported 28 percent, and 59 percent of the cones were located on main side branches. Thus, by taking into account only the number of main branch tips and main side branches, it is possible to determine the relationship between cone production and such dominant growing points.

Even though a large proportion of the growing points are located on the lower half of the live crown, this portion of the crown can be excluded from such an investigation since only 15 percent of the total cones found on the tree appeared here. Thirty-five percent of the cones were found in the top quarter and 50 percent in the next-to-top quarter of the crown.

The r-value for the relationship between number of dominant growing points and cone production was only 0.088, a non-significant value. The number of dominant buds in the upper half of the crown evidently is of little importance in accounting for the number of cones which will be produced. The proportion of buds that produces "flower" primordia must be the determining factor.

TABLE 4.—CORRELATION COEFFICIENTS FOR CONE PRODUCTION AND CROWN MEASUREMENTS

Variable	r
Branch volume	0.529***
Length of live crown	0.367**
Crown length/tree length	0.057 not signif.

Site Effects on Cone Production

Since only 15 different areas were tested and the variation in site index was rather small, the present study of effect of site quality on cone production may be of limited value. From results of correlation analysis ($r = .078$) it appears that trees on both good and relatively poor sites have about the same ability to produce cones.

An analysis of variance was made to determine if there were any real differences in cone-producing ability among the five areas. In the Ahoskie area cone production proved to be significantly lower than in the four areas farther south. This significant difference was due to the relatively poor crop produced in 1958 in this area.

Old Cones as Indicators of Future Crops

Some workers (*4, 5, 7, 11*) have observed a strong positive correlation between numbers of old and new cones; they recommend using old cones as an indicator of the degree of future fruitfulness. The value of such an indicator depends to some degree on the variation between trees in ability to retain the old cones. If the variation is great, such an indicator would be of limited value.

Plotting the average number of cones in the 1957-1958 crop against the number of old cones present in 1957 (Fig. 4) clearly indicates considerable variation between trees. Nevertheless, the correlation coefficient was high ($r = 0.641$ ***). Thus, the presence or absence of old cones will give the observer a valuable clue to future fruitfulness of a tree. Where it is feasible to make a relatively accurate count of the fallen old cones for a specific tree, the estimate will be more precise.

An analysis of variance was made to determine if local climatic conditions have any effect upon

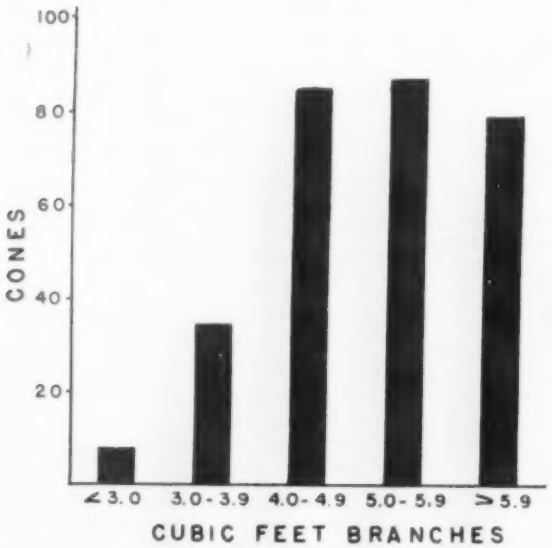


FIG. 3.—Number of mature cones produced by trees in different branch volume classes.

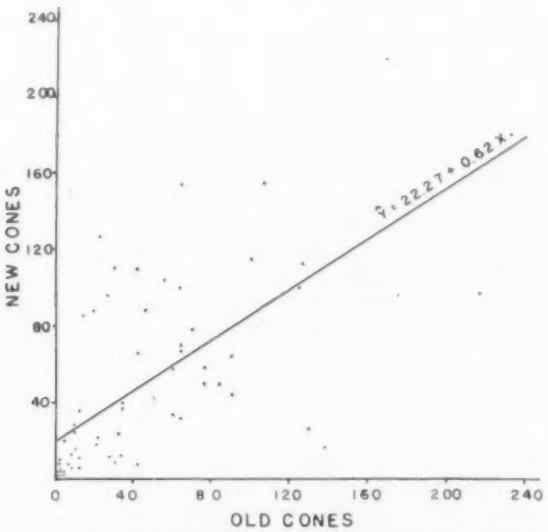


FIG. 4.—Sample regression of number of mature new cones on presence of old persistent cones.

how long the old cones remain persistent. There was no significant difference between the areas in this respect.

Silvicultural Considerations

To get some estimate of the number of seed trees (not pre-released) required on the Coastal Plain of North Carolina, the author collected cones from five trees in 15 different stands (altogether 75 trees) and found that on an average there were 85 seeds per cone and 54 cones, or 4,590 seeds, per tree. According to Trousdell (*8*), seed requirements vary from 83 to 7 seeds per seedling, depending upon conditions of seed bed. This means that only five or six good seed trees are needed per acre when the seed bed conditions are favorable. However, under unfavorable conditions, the number of seed trees required tends to be too large for silvicultural consideration. Preharvest release (*9*) is most likely required for adequate reproduction of such seed beds.

For cone production there appears to be a threshold value with regard to both diameter breast height and branch volume. When loblolly pines in a closed stand have a branch volume of less than three to four cubic feet, or a diameter of less than 12 inches, they are apparently not capable, as a rule, of producing many cones. Trees selected for cone production should all be dominants or codominants, more than 12 inches d.b.h. and have a branch volume of at least four cubic feet. Also, they should show evidence of previous cone production.

In some stands there is a relatively large number of trees that are good cone producers. Under such circumstances, it is advisable to cull trees with crooked stems and excessively large crowns, and to leave the best phenotypes among the good cone producers for seed trees. By following such a procedure, the resulting reproduction will probably be of a somewhat better quality.

Summary

In this study of cone production in loblolly pine on the Coastal Plain of North Carolina during 1957 and 1958, the following results were obtained:

1. Superior trees previously selected in the North Carolina State-Industry Cooperative Forest Tree Improvement Program have a cone production capacity not inferior to that of "woods-run" crop trees.

2. The association between d.b.h. or stem volume and cone production is significant at the 0.1 percent level. About one-third of the total variation in cone production is accounted for by either of these variables.

3. Total tree height accounts for only 13 percent of the variation.

4. The sample correlation coefficient between branch volume and cone production was significant at the 0.1 percent level. However, the relationship may not be strictly linear, the yield of cones becoming constant rather abruptly at a branch volume of approximately four cubic feet.

5. Length of live crowns accounts for only 13 percent of the variation, and the crown length-tree length ratio has no predictive value.

6. The proportion of buds producing female "flower" primordia, rather than total number of buds, determines the fecundity of a tree.

7. There was no difference in cone production between trees growing on average or high sites.

8. The presence or absence of old cones gives a good estimate of future cone crops. More than 41 percent of the total variation can be accounted for by this observation.

Acknowledgments

The author wishes to thank Mr. K. S. Trowbridge of North Carolina Pulp and Paper Company, Division of Weyerhaeuser Company, for the use of land, equipment and labor. Grateful acknowledgment is made to Dr. B. J. Zobel and Dr. T. E. Maki for critical reading of the manuscript

The assistantship granted by the N. C. State-Industry Cooperative Forest Tree Improvement Program is greatly appreciated.

Literature Cited

1. COILE, T. S. 1952. Soil and the growth of forests. Adv. in Agron. 4:329-398.
2. DOWN, A. A. 1947. Choosing pine seed trees. Jour. Forestry 45:593-594.
3. GODDARD, R. E. 1958. Additional data on cost of collecting cones from a seed production area. Jour. Forestry 56:846-848.
4. GRANO, C. X. 1951. What loblollies are likely cone producers Jour. Forestry 49:734.
5. ———. 1957. Indices to potential cone production of loblolly pine. Jour. Forestry 55:890-891.
6. LINDQUIST, B. 1946. Den Skogliga Rasforskningen och Praktiken (Genetics and the Practice of Forestry). Svenska Skogsvardsforeningens Forlag, Stockholm. 176 pp.
7. FOMEROY, K. B. 1949. Loblolly pine seed trees; selection, fruitfulness, and mortality. Southeast. For. Expt. Sta., Sta. Paper No. 5, 17 pp.
8. TROUSDELL, K. B. 1950. Seed and seedbed requirements to regenerate loblolly pine. Southeast. For. Expt. Sta., Sta. Paper No. 8, 13 pp.
9. WENGER, K. F. 1954. The stimulation of loblolly pine seed trees by preharvest release. Jour. Forestry 52:115-118.
10. ———. 1957. Annual variation in the seed crops of loblolly pine. Jour. Forestry 55:567-569.
11. ———, and K. B. TROUSDELL. 1957. Natural regeneration of loblolly pine in the South Atlantic Coastal Plain. Prod. Res. Report No. 13, U.S.D.A., 78 pp.

Site Index of Ponderosa Pine in the Black Hills From Soil and Topography[1]

Clifford A. Myers and James L. Van Deusen

INCREASING amounts of thinning, pruning, and planting are being done in the Black Hills of South Dakota and Wyoming. These silvicultural practices give the best results where the growth potential is greatest. To determine the potential, a reliable measure of site quality is needed that will be usable under a wide variety of conditions and easily applied in the field.

Indexes of site quality based on conventional height-age relationships are unreliable or impossible to obtain under certain conditions. In deforested areas, only methods based on permanent features of soil and topography can be used. The conventional method is inaccurate in young stands, and in all stands where exceptionally high or low stand density has restricted height growth. Thus, incorrect site evaluation in apparently well-stocked older stands can be due to extreme densities in the past. Use of soil and topography for site index determination provides a means of avoiding errors in all these cases. It may often be advantageous to determine site index from soil and topography even in continuously well-stocked, even-aged stands. Unless the soil is deep or very rocky, site index can be obtained quicker by this method than by the use of average age and height.

A site classification based primarily on slope position and aspect is now being used in the Black Hills (*12*). Three classes are recognized: Area I, the best sites; Area II, average; and Area III, below average sites. Bottoms and lower slopes from northwest clockwise to southeast are classed as the best sites. Upper south to west slopes are considered to be below average. Other combinations of slope position and aspect are average except that ridge tops are included only if soil is estimated to be deep. Soil is considered to be deep on Area I, moderately deep on Area II, and shallow on Area III.

This paper presents a method of determining site indexes for the Black Hills and Bear Lodge Mountains that does not have the limitations of the methods discussed above.

Other Work

Studies in many parts of the country have shown that indicators of capacity for holding available soil moisture can be used to estimate site index. Permanent features of the soil profile, parent material, and topography have proven useful.

Surface or total soil depth is usually the best indicator of site index. Site index increases directly with soil depth or thickness of the surface layer for both conifers (*4, 5, 6, 9, 15, 19*) and hardwoods (*1, 2, 7, 8, 10, 18*).

Site index is also associated with topographic position. Site index decreases with increased distance upslope (*7, 8, 10, 18*) and with increased steepness of slope (*15, 18, 20*). The latter relationship is sometimes not statistically significant (*7, 10*). Aspect can be either a significant (*10, 18*) or a nonsignificant (*7*) factor in the estimation of site index. In the latter case, the effect of aspect was probably confounded with those of other variables.

Soil texture is related to site quality with both conifers (*11, 20*) and hardwoods (*7*) but usually does not appear in site index equations for rough or mountainous country. Holtby (*13*) found a relationship between soil texture and the site quality of ponderosa pine in level to gently rolling areas of southeastern Washington. He found no such relation for Douglas-fir in the rough topography of western Washington.

Elevation and precipitation have seldom been correlated with site index. Most studies, however, have been made in areas where the range of these variables is small or where their effects are confounded with those of other factors.

Study Area

Ponderosa pine (*Pinus ponderosa* Laws.) is the most important tree species in the Black Hills and in the Bear Lodge Mountains of Wyoming (Fig. 1). At least 95 percent of the total commercial sawtimber volume is ponderosa pine. Pure, even-aged, or two-storied stands are usual. The area

THE AUTHORS are foresters with the Rocky Mountain Forest and Range Expt. Sta., Forest Service, U. S. Dept. Agric. central headquarters at Fort Collins in cooperation with Colorado State University.

[1]Research reported in this article was conducted by the Station's field unit at Rapid City, S. Dak. in cooperation with South Dakota School of Mines and Technology.

sampled in this study approximately coincides with the commercial forest zone. This zone averages 80 miles long and 40 miles wide in the Black Hills.

Precipitation.—Average annual precipitation ranges from 17 inches in the southern to 27 inches in the northern Black Hills. Most of the northern Black Hills receives 20 to 24 inches. Annual precipitation averages 18 to 24 inches in the Bear Lodge Mountains. Sixty to 70 percent of the annual precipitation falls from May to September.

Geologic areas.—The Black Hills and Bear Lodge Mountains each consist of an exposed crystalline core surrounded by sedimentary formations. The central portion, the Crystalline Area (Fig. 1), is composed of metamorphic rocks (schists, slates, phyllites, and quartzite), granites, and igneous extrusives (mostly phonolites and rhyolites). This area is characterized by rough to rounded hills and divides with elevations, except for isolated peaks, ranging from 4,300 to 6,000 feet. The Crystalline Area is surrounded by the Limestone Area (Fig. 1) consisting of limestone members of the Pahasapa, Minnelusa, and Minnekahta formations. On the eastern side of the Black Hills, limestones form a hogback occasionally flattening out to narrow uplands with elevations of 3,600 to 4,400 feet. Elsewhere, the limestones form wide, rather level divides separated by narrow, steep valleys; elevations range from 4,500 to 7,000 feet.

Methods

Forty-two 1/5-acre plots were examined in the Limestone Area and 65 in the Crystalline Area (Fig. 1). Plots were located only in even-aged (20-year range) stands there were 100 to 200 years old. Only stands that were well stocked and without evidence of past suppression were sampled. Topography and stand conditions were uniform on and adjacent to each plot.

Sample trees.—Age and total height were measured on 6 to 8 dominant trees on each plot. Trees with western gall rust (*Peridermium harknessii* Moore ex Hark.), forking, or other defect that might affect height growth were not selected as sample trees. No plots were rejected on the basis of defective trees present; all plots had enough healthy, well-formed dominants for site index determination.

Soils data.—Complete soil profile descriptions, following instructions of the Soil Survey Manual (*17*), were obtained from a pit dug at each plot center. Horizon thicknesses were measured to the nearest inch. Percentage of each horizon occupied by rocks greater than 2 mm. in diameter was estimated on the pit wall. The pH of each horizon was determined with a Helige soil reaction kit. Texture of each horizon was determined by dispersing the samples with a reciprocating shaker and using the hydrometer method of Bouyoucos (*3*). Soil surveys have not been made in the Black Hills; therefore, correlated series names could not be used for the soils studied.

Topographic features.—Aspect from true north, elevation, and grade or slope percent were measured on each plot. Total slope length and distance from bottom of slope to plot center were determined by pacing.

Analysis.—The data were analyzed by multiple regression. Site index of each plot was determined from Hornibrook's curves for ponderosa pine in the Black Hills

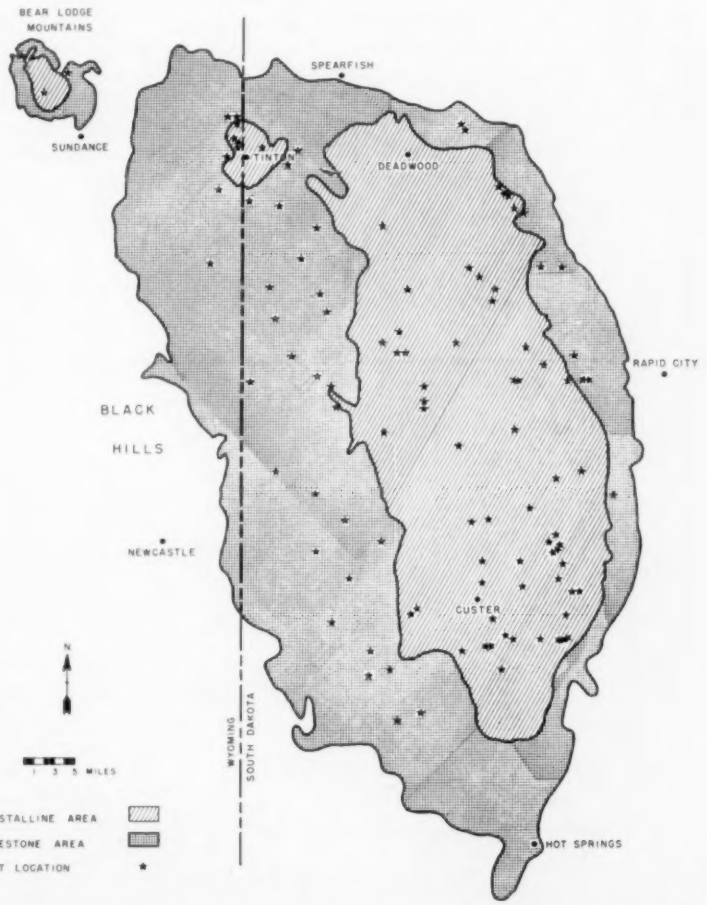


FIG. 1.—Crystalline and Limestone Areas and plot locations in the Black Hills and Bear Lodge Mountains of South Dakota and Wyoming.

TABLE 1.—SITE INDEX OF PONDEROSA PINE IN THE CRYSTALLINE AREA OF THE BLACK HILLS AND BEAR LODGE MOUNTAINS, NORTHWEST AND SOUTHEAST SLOPES[1]

Soil depth (inches)	Slope percent									
	0	10	30	50	70	0	10	30	50	70
	100% upslope					60% upslope				
	Site index, feet									
5	43	42	40	38	36	46	45	43	41	39
10	47	46	44	42	40	51	50	47	45	43
15	49	48	46	44	—	54	52	50	48	45
20	51	50	48	46	—	56	55	52	50	47
30	54	53	50	—	—	59	58	55	52	50
40	56	55	52	—	—	61	60	57	54	52
	30% upslope					0% upslope				
	Site index, feet									
5	49	48	46	44	42	53	51	49	—	—
10	54	53	50	48	46	58	56	54	—	—
15	57	56	53	51	48	61	59	57	—	—
20	59	58	55	53	50	63	62	59	—	—
30	63	61	58	56	53	67	65	62	—	—
40	65	64	61	58	55	69	68	65	—	—
60	69	67	—	—	—	73	72	—	—	—

[1]Add one foot for north and east slopes and two feet for northeast slopes. Subtract one foot for south and west slopes and two feet for southwest slopes.

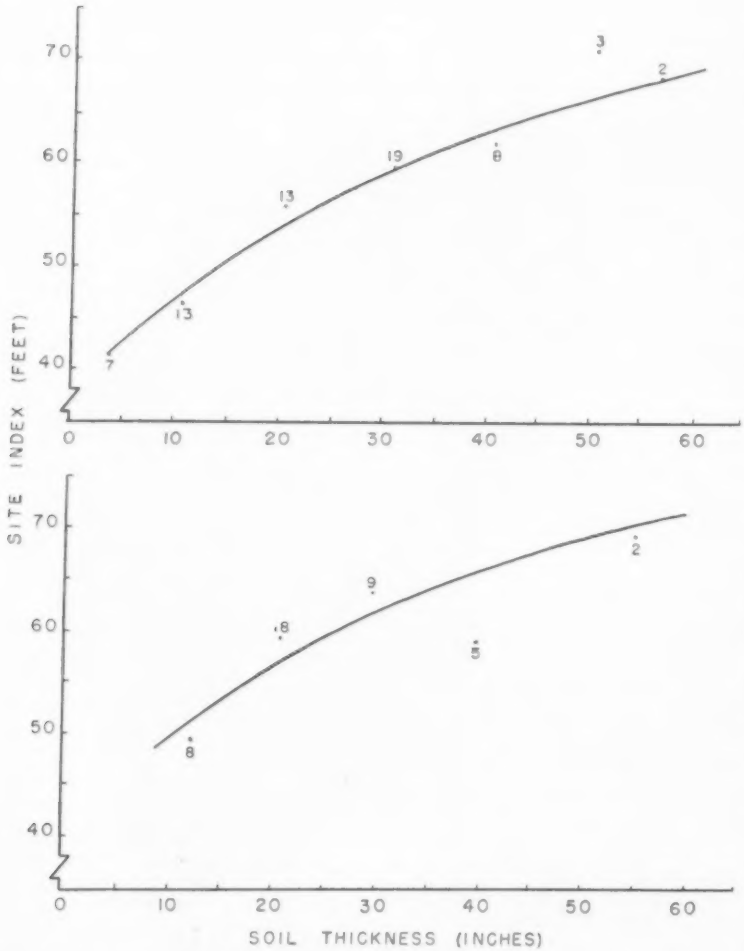


FIG. 2.—The relation of ponderosa pine site index to soil depth in the Black Hills and Bear Lodge Mountains; upper: Crystalline Area, lower: Limestone Area. Numbers near points indicate number of plots.

(*14*). The base age of these curves is 100 years. Site index was then plotted over each independent variable and nonlinear relations were converted to linear form. Independent variables definitely not related to site index were discarded. The remaining variables were tested for significance by solving reciprocal matrices and analysis of variance. Significant independent variables were again checked for linearity with site index, using residuals from partial regression equations. Residuals of the final multiple regression equations were then plotted against each independent variable not used in the equations to insure that no significant factor had been overlooked. Plots on soils from igneous and metamorphic rocks were sufficiently similar to be analyzed as a single group but separate analysis was necessary for soils developed from limestone.

Results

Four readily measured variables can be used to estimate the site index of ponderosa pine in the Black Hills and Bear Lodge Mountains. They are: (1) soil depth to top of the C horizon, (2) slope position (distance up the slope as a percentage of total slope length), (3) slope percent, and (4) aspect. All four should be used in the Crystalline Area but only soil depth and slope position are needed in the Limestone Area.

Crystalline area.—Where the soil is derived from metamorphic or igneous rocks or a mixture of both:

$$Y = 1.64660 - 0.10315\ X_1 - 0.01895\ X_2 - 0.09042\ X_3 + 0.13330\ X_4$$ (Table 1) where:

Y = Logarithm of site index.

X_1 = Grade or percent of slope, as a decimal.

X_2 = Aspect as the sine of the azimuth clockwise from southeast, plus one (*10*).

X_3 = Distance of plot center up the slope as a percentage of total slope length, expressed as a decimal.

X_4 = Logarithm of soil depth in inches to top of C horizon.

The multiple correlation coefficient (R) is 0.913 with 83 percent of the variance in site index accounted for. Test of R and analysis of variance show that R and all independent variables are statistically significant at the 1 percent level. The standard error of estimate is about 8 percent at average site index, 54 feet.

Limestone area.—Where the soil is derived wholly or mainly from limestone:
$Y = 1.54200 - 0.11819\ X_3 + 0.20821\ X_4$ (Table 2) with symbols as defined above. R is 0.822 with 78 percent of the variance in site index accounted for. R and both independent variables are significant at the 1 percent level. The standard error of estimate is about 7 percent at average site index, 58 feet.

Special situations.—Two special situations may be encountered in the field: (1) All bottoms, whether main or side valley, should be called 0 percent of the distance upslope. (2) Sloping ridges with tops more than 3 chains wide should be measured as slopes. A ridge top should be classed as 100 percent up the slope only when the ridge line is approximately level or less than 3 chains wide.

Nonsignificant factors.—Several factors were not useful estimators of site index. Slope percent and aspect were nonsignificant in the Limestone Area. Others that were nonsignificant in both areas include: (1) precipitation (from an isohyetal map), (2) elevation, (3) slope length, (4) percent sand and thickness of the A and C horizons, and (5) effective soil depth (total soil depth reduced by the percentage of rock present). Products of soil depth and slope position, slope percent and slope position, slope percent and aspect, and aspect and slope position were also nonsignificant.

Discussion

Relative importance of factors.—Soil depth to top of the C horizon was the most important factor in determining site index in the study area. In the Crystalline Area soil depth alone accounted for 67 percent of the total variation in site index. Slope position alone accounted for 46 percent of the total variation, but due to the correlation between soil depth and slope position ($r = 0.68$), it only accounted for an additional 7.0 percent of the total variation after the effect of depth is eliminated. When the effects of soil depth and slope position are eliminated, slope accounts for 6.0 percent of the total variation leaving a residual of 3.0 percent for aspect.

In the Limestone Area soil depth alone accounted for 48 percent of the total variation and slope position accounted for 30 percent after soil depth. The correlation between these two variables was not significant.

Comparison of areas.—Soils selected to illustrate conditions on the plots sampled are described in Table 3. Soil depth and other features vary widely at each slope position because of gradient and other factors influencing soil development. Surface soils in the Limestone Area are usually finer in texture and higher in pH than those in the Crystalline Area. Only in alluvial bottoms are these factors similar in both areas. Measured soil depths to the C horizon ranged from 3 to 57 inches in both areas, with the deepest soils in the bottoms. Soils are usually deeper on upper slopes in the Limestone Area than in similar positions in the Crystalline Area. Range of depth to bedrock and its change with slope position follow the same trends. Depth to bedrock could not be correlated with site index in much of the Crystalline Area because tree roots penetrate deep fractures in the steeply tilted schist and slate layers. In the Limestone Area the top of the bedrock is less broken and depth to bedrock could have been used instead of depth to the C horizon for estimating site index.

More plots in the Limestone Area had above-average sites than in the Crystalline Area. Observed site index values, however, had the same range in both areas, 36 to 75 feet. Site index probably averaged higher in the Limestone Area because much of this area, especial-

TABLE 2.—SITE INDEX OF PONDEROSA PINE IN THE LIMESTONE AREA OF THE BLACK HILLS AND BEAR LODGE MOUNTAINS

Distance upslope (percent)	Soil depth—inches												
	5	8	10	13	15	20	25	30	35	40	45	50	55
	Site index, feet												
0	—	—	—	59	61	65	68	71	73	75	77	79	80
10	—	—	—	58	60	63	66	69	71	73	75	77	78
20	—	—	—	56	58	62	64	67	69	71	73	74	76
30	—	—	—	55	56	60	63	65	67	69	71	72	74
40	—	—	50	53	55	58	61	63	65	67	69	71	72
50	—	—	49	52	53	57	59	62	64	66	67	69	70
60	—	—	48	50	52	55	58	60	62	64	65	67	68
70	40	44	47	49	51	54	56	58	60	62	64	65	66
80	39	43	45	48	49	52	55	57	59	60	—	—	—
90	38	42	44	47	48	51	53	55	57	59	—	—	—
100	37	41	43	45	47	50	52	54	56	57	—	—	—

TABLE 3.—CHARACTERISTIC SOIL FEATURES AS DETERMINED BY PARENT MATERIAL AND SLOPE POSITION

Area	Slope position	Horizon thickness		Depth to bedrock	Surface soil		Site index
		A	B		Texture	pH	
		Inches	*Inches*	*Inches*			*Feet*
Crystalline	Bottom	10	31	60	Loam	6.0	67
	Middle	13	20	43	Loam	6.2	56
	Upper	8	0	14	Loam	5.5	39
Limestone	Bottom	6	26	55	Sandy loam	6.0	71
	Middle	8	23	50	Clay loam	7.5	62
	Upper	6	15	30	Clay loam	8.0	49

CATERPILLAR ANNOUNCES 2 NEW

NEW 150 HP 977H WITH 2½ CU. YD. BUCKET

Travel speeds: Forward—Low: 2.0 MPH 1st; 3.6 MPH 2nd. High: 2.5 MPH 1st; 4.7 MPH 2nd. Reverse speeds 25% faster than forward.

NEW 100 HP 955H WITH 1¾ CU. YD. BUCKET

Travel speeds: Forward—Low: 2.1 MPH 1st; 3.9 MPH 2nd. High: 2.7 MPH 1st; 4.9 MPH 2nd. Reverse speeds 25% faster than forward.

TRAXCAVATORS

with Power Shift Transmission and Live Action Hydraulics

977 SERIES H
955 SERIES H

all new for new high production

There is a way to beat higher costs—and that's with increased production. For tractor-loader jobs, here's your answer in the new Series H Cat 977 and 955 Traxcavators. Designed to set a production pace far faster than the models they replace (and other makes of comparable size), they're milestones in tractor-loader progress. With power shift transmission and Live Action Hydraulics, they're the loaders *that never stop.*

There may be machines in your line-up that are no longer paying their way—or not earning *all* the profits they should. A comparison of your existing loaders with the new Series H Traxcavators could easily prove these new machines would increase your output and profits far more than you imagine. Get the facts from your Caterpillar Dealer. Ask for a demonstration, too. See for yourself how they set a new production pace on the toughest kind of job.

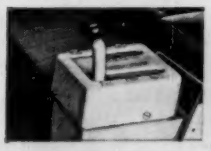
Caterpillar Tractor Co., General Offices, Peoria, Ill., U. S. A.

CATERPILLAR

Caterpillar, Cat and Traxcavator are Registered Trademarks of Caterpillar Tractor Co.

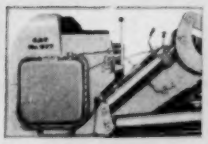
TRAXCAVATORS ARE MAKING OTHER LOADERS OBSOLETE

NEW HIGH PRODUCTION FEATURES SPEED LOADING, LIFTING, HAULING, DUMPING . . . THE FULL CYCLE



NEW POWER SHIFT TRANSMISSION

One lever—that's right, one lever gives split-second changes in speed or direction to slash cycle times and increase operator efficiency.



NEW LIVE ACTION HYDRAULICS

Another Caterpillar development! Live Action Hydraulics provide faster lifting speed and greater lifting capacity without robbing power from the tracks. The 977H Traxcavator packs 41% more hydraulic lifting power—the 955H, 23% more than former models.

MORE HORSEPOWER WITH NEW CAT TURBOCHARGED ENGINES

Up 50% on the 977H—its new Cat D333 Engine develops 150 HP at the flywheel. Up 43% on the 955H with a new Cat D330 Engine that develops 100 flywheel HP.

NEW INCREASED BUCKET CAPACITY

An 11% increase on the new 977H with new 2½ cu. yd. bucket—and a 16.6% increase on the 955H with new 1¾ cu. yd. bucket. Complete redesign of engine, power train and chassis provides new machine balance to handle the heavier loads.

NEW HEAVY-DUTY UNDERCARRIAGE

Many new features, including larger, stronger track components that also increase stability . . . lifetime lubricated rollers with patented floating ring seals need no servicing . . . and track guiding guards welded to the roller frame for positive track alignment. The 955 Series H Traxcavator also features a new 6-roller track frame and hydraulic track adjusters, both standard equipment.

MORE HIGH PRODUCTION FEATURES

A new, two-cylinder gasoline starting engine for positive starts in any weather . . . and a new dry-type air cleaner that removes at least 99.8% of all dirt from intake air in the worst dust conditions, cuts maintenance time as much as 75%. Retained features include 40° bucket tilt back . . . automatic bucket positioners and kick out . . . 3-grouser track shoes.

QUICK-CHANGE ATTACHMENTS

Bar none, Traxcavators are the most versatile machines you can use. With attachments, you can always keep them working—and working profitably. Attachments available for the new 977 and 955 include the Side Dump Bucket, Rock Bucket, Quarry Bucket, Bulldozer, Ripper and Log and Lumber Forks.

ly the northwestern plateau, is gently rolling and favorable for the formation of deeper soils. Conversely, steep slopes and shallow soils are common in the Crystalline Area. Even on upper slopes, the soil is deeper and more highly developed (better structure and a B horizon present) in the Limestone Area than in corresponding positions in the Crystalline Area.

Influence on management.—Although the observed range of site indexes is small, it is sufficient to influence the intensity of management. Dominant trees in well-stocked stands on the better sites (Fig. 3) averaged 18 to 20 inches d.b.h. at rotation age (160 years). On such sites, intensive stand improvement measures, such as thinning and pruning, appear justified. Dominants barely reached the minimum sawtimber size of 10 inches d.b.h. at rotation age in well-stocked stands on the poorest sites (Fig. 4). Here, only the most extensive management practices appear economically feasible now. Site indexes between 50 and 67 are most frequent within the commercial forest zone of the Black Hills and Bear Lodge Mountains.

The Black Hills area classification system now in use (*12*) identifies site quality only in a general way. Of the plots examined for this study, those classed as Area I (above average) had indexes from 50 to 75. Site indexes ranged from 37 to 69 on Area II (average) and from 36 to 57 on Area III (below average) sites. The differences found are believed to be due primarily to the inclusion of aspect as a major factor and the omission of soil depth measurements in the area classification system. The method presented in this paper identifies site quality much more accurately than the area classification system. It should, therefore, provide a better aid for intensive management.

Summary

Equations for estimating site index have been developed for the two major timber producing areas of the Black Hills and Bear Lodge Mountains. These two areas are: (1) Crystalline, where the soil has been formed from metamorphic and igneous rocks, and (2) Limestone, with soil formed wholly or primarily from limestone. A total of 107 1/5-acre plots were examined on both areas, with site index and important soil and topographic characteristics recorded for each plot.

In the Crystalline Area site index can be estimated with four easily measured variables: (1) soil depth to the top of the C horizon; (2) distance of sampling point up the slope expressed as a percentage of total slope length; (3) grade or percent of slope; and (4) aspect. The standard error of estimate was about 8 percent at aver-

FIG. 3.—A stand in the Crystalline Area on an alluvial bottom with 41 inches of soil and an east aspect. Dominants average 128 years old, 79 feet tall, and 17.4 inches d.b.h. Site index by conventional method, 67 feet.

FIG. 4.—A poor site on a ridge top in the Crystalline Area with 3 inches of soil and a southwest aspect. The largest dominants have produced one 16-foot sawlog of the smallest acceptable diameter in 189 years. Dominants average 47 feet tall and 11.7 inches d.b.h. Site index by conventional method, 36 feet.

age site index, 54 feet.

Two variables are required to estimate site index in the Limestone Area: (1) soil depth to the top of the C horzon, and (2) percent distance up the slope. The standard error of estimate was about 7 percent at average site index, 58 feet.

On both areas soil depth accounted for most of the variance in site index, while slope position was second in importance. Only in the Crystalline Area did aspect and slope percent appear statistically significant.

Literature Cited

1. AUTEN, J. T. 1945. Some soil factors associated with site quality for planted black locust and black walnut. Jour. Forestry 43:592-598.
2. ————. 1945. Prediction of site index for yellow-poplar from soil and topography. Jour. Forestry 43: 662-668.
3. BOUYOUCOS, GEORGE JOHN. 1951. A recalibration of the hydrometer method for making mechanical analysis of soils. Agron. Jour. 43:434-437.
4. CARMEAN, WILLARD H. 1954. Site quality for Douglas-fir in southwestern Washington and its relationship to precipitation, elevation, and physical soil properties. Proc. Soil Sci. Soc. Amer. 18:330-334.
5. COILE, T. S., and F. X. SCHUMACHER. 1953. Relation of soil properties to site index of loblolly and shortleaf pines in the Piedmont region of the Carolinas, Georgia, and Alabama. Jour. Forestry 51:739-744.
6. COPELAND, OTIS L., JR. 1956. Preliminary soil-site studies in the western white pine type. U. S. Forest Serv. Intermountain Forest and Range Expt. Sta. Research Note 33. 4 pp. (Processed).
7. DOOLITTLE, WARREN T. 1957. Site index of scarlet and black oak in relation to southern Appalachian soil and topography. Forest Sci. 3: 114-124.
8. EINSPAHR, DEAN, and A. L. MCCOMB. 1951. Site index of oaks in relation to soil and topography in northeastern Iowa. Jour. Forestry 49:719-723.
9. GAISER, R. N. 1950. Relation between soil characteristics and site index of loblolly pine in the coastal plain region of Virginia and the Carolinas. Jour. Forestry 48:271-275.
10. ————. 1951. Relation between topography, soil characteristics, and the site index of white oak in southeastern Ohio. U. S. Forest Serv. Central States Forest Expt. Sta. Tech. Paper 121. 12 pp. (Processed.)
11. GESSELL, STANLEY P., and WILLIAM J. LLOYD. 1950. Effect of some physical soil properties on Douglas-fir site quality. Jour. Forestry 48:405-410.
12. HARMON, WENDELL H. 1955. Ponderosa pine management in the Black Hills. Ames Forester 42:6-8.
13. HOLTBY, B. E. 1947. Soil texture as a site indicator in the ponderosa pine stands of southeastern Washington. Jour. Forestry 45:824-825.
14. HORNIBROOK, E. M. 1939. Preliminary yield tables for selectively cut stands of ponderosa pine in the Black Hills. Jour. Forestry 37:807-812.
15. LEMMON, PAUL E. 1955. Factors affecting productivity of some lands in the Willamette Basin of Oregon for Douglas-fir timber. Jour. Forestry 43:323-330.
16. MEYER, WALTER H. 1938. Yield of even-aged stands of ponderosa pine. U. S. Dept. Agric. Tech. Bull. 630. 59 pp.
17. SOIL SURVEY STAFF. 1951. Soil survey manual. U. S. Dept. Agric. Handbook 18. 503 pp. (pp. 123-250).
18. TRIMBLE, G. R., JR., and SIDNEY WEITZMAN. 1956. Site index studies of upland oaks in the northern Appalachians. Forest Sci. 2:162-173.
19. ZAHNER, ROBERT. 1954. Estimating loblolly pine sites in the Gulf Coastal Plain. Jour. Forestry 52: 448-449.
20. ————. 1957. Field procedures for soil-site classification of pine land in south Arkansas and north Louisiana. U. S. Forest Serv. Southern Forest Expt. Sta., Occas. Paper 155. 17 pp. (Processed).

Coming Events

Northeastern Forest Tree Improvement Conference

The eighth NEFTIC meetings will be held on the campus of Yale University in New Haven, Conn., August 18-19. Dormitory facilities of the University will be available for NEF TIC members.

Allegheny Section

The Allegheny Section will hold a meeting at the Hotel Casey, Scranton, Pa., August 18-20, 1960.

Upper Mississippi Valley Section

The summer meeting of the Upper Mississippi Valley Section will be held in Duluth, Minn., August 18-20, 1960.

Society of American Foresters

The sixtieth anniversary meeting of the Society of American Foresters will be held at the Sheraton-Park Hotel, Washington, D. C., November 13-16, 1960.

Central States Section

The meeting of the Central States Section will be held at Franklin Park. Ill., a (west) suburb of Chicago, on October 13-14, 1960. The theme is Recreation.

Canadian Institute of Forestry

The 1960 annual meeting of the Canadian Institute of Forestry will be held at the Chateau Frontenac, Quebec City, Canada, October 24-27, 1960.

Watersheds A and B—A Study of Surface Runoff and Erosion in the Subalpine Zone of Central Utah

Richard O. Meeuwig

WATERSHEDS A and B, in the head of Ephraim Canyon in central Utah, have been under continuous study since they were established in 1912 to provide information on the influence of herbaceous cover on surface runoff and erosion. This study, still in progress, has yielded information on surface runoff and erosion under a variety of herbaceous cover conditions. Among the many important facts learned from this long-term study are these:

1. Natural recovery of damaged watersheds proceeds very slowly under the particular soil and climatic conditions of this area: clay loam soils, high intensity summer storms, and variable plant cover.

2. Restoration treatments hasten recovery of damaged areas with an accompanying improvement in quality and quantity of forage production.

3. There is a minimum ground cover essential to the control of surface runoff and erosion.

The subalpine zone of the Wasatch Plateau, where these two experimental watersheds are located, was described in detail recently by Ellison (*1*). Vegetation is predominantly herbaceous, but scattered patches of Engelmann spruce (*Picea engelmanni* Parry) and subalpine fir (*Abies lasiocarpa* [Hook.] Nutt.) also occur.

Annual precipitation averages 33 inches. Precipitation averages only about 6 inches during the 3-month summer growing season but varies considerably from year to year. Vegetation in this zone depends primarily on the moisture stored in the soil during spring snowmelt rather than on summer rainfall. During most of the year, storms are of the low intensity orographic type; but in the summer months, particularly July and August, high intensity convectional storms often occur. Rainfall intensities as high as 2.2 inches per hour for a 20-minute period have been recorded on the two experimental watersheds. These brief storms are strongly localized, but there is probably no area on this plateau where high intensity storms do not occur at least once every few years.

Grazing in the subalpine zone began between 1870 and 1880. In the years that followed, summer floods occurred with increasing severity and frequency and caused widespread damage to communities along the west face of the Wasatch Plateau. Most of these floods originated in the subalpine zone where grazing had depleted the original full cover of tall broadleaf herbs and grasses to a sparse cover composed of low-growing broadleaf herbs, mostly annuals. Floods occurred when intense summer storms produced surface runoff from the depleted slopes. As sediment-laden runoff concentrated in the stream channels, it picked up additional sediment and debris, and often became a mudrock flow by the time it reached the settlements at the mouths of the canyons.

THE AUTHOR is forester, Intermountain Forest and Range Expt. Sta., Forest Service, U. S. Dept. Agric., stationed at the field research center, Ephraim, Utah.

Experimental Watersheds

The two experimental watersheds, about 900 feet apart, are at an elevation of 10,000 feet in a west-facing slope at the crest of the Wasatch Plateau. Both are typical of extensive portions of the subalpine zone. Average slope is 18.5 percent on Watershed A and 16.3 percent on Watershed B. Soils on these watersheds are residual clays and clay loams derived from limestone and bituminous shales. Watershed A occupies an area of 11 acres and B an area of 9 acres. Both are complete watersheds though neither has a permanent stream.

When the study was started in 1912, Watershed A had an average plant cover of 16 per cent (Fig. 1*A*). It had been abusively overgrazed for many years and was typical of many severely depleted and eroded areas in the subalpine zone. Watershed B had not been grazed so heavily and its plant cover averaged 40 percent. Erosion was active on some parts of B but it was not so widespread as on A.

Measurements

Surface runoff and sediment from these watersheds have been measured since 1915. Records of summer storm intensities have been obtained from recording rain gages since 1919. Vegetation surveys have been made periodically since 1912. The reconnaissance method was used in the earlier surveys, but more recently, ground cover on the watersheds has been determined by the point method (*3*), which

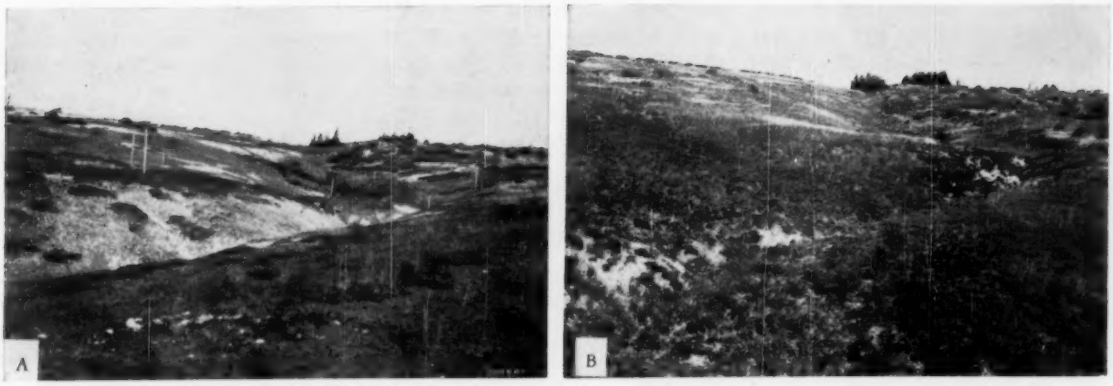


FIG. 1.—General view of Watershed A: (*A*) in 1915 before protection from grazing; (*B*) in 1958 after 38 years of protection. Many large bare areas have revegetated, but some portions still are inadequately covered.

gives about the same cover estimate as the reconnaissance method.

Treatments

Watershed A, already depleted in 1912, was maintained in that condition by grazing for the first 8 years of the study; then it was allowed to recover naturally. It was not grazed in 1920 and has been grazed only lightly on a few occasions since then.

Plant cover on Watershed B was maintained by controlled grazing at its original 40 percent density until 1931, when it was reduced to 30 percent by heavier grazing. This treatment continued until 1942. Neither watershed was grazed from 1942 through 1945. From 1946 through 1951, Watershed B was depleted by heavy grazing so that it became a flood-source area comparable to what Watershed A had been before 1920. In the fall of 1952 it was artificially restored by disking, contour trenching, and seeding, and has not been grazed since.

To relate results to major vegetation changes, the history of the A—B Watershed study is divided into six periods:

Period	Years	Watershed condition A	Watershed condition B
I	1912-1920	Depleted	Fair
II	1921-1923	Recovering	Fair
III	1924-1930	Restored naturally	Fair
IV	1931-1945	Restored naturally	Poor
V	1946-1952	Restored naturally	Depleted
VI	1953-1958	Restored naturally	Restored artificially

Average plant cover densities and average annual summer storm runoff and sediment production during these periods are summarized in Table 1. Spring snowmelt runoff and spring sediment production are not included because snowmelt runoff rarely produces floods and depends primarily on snowpack conditions rather than on plant cover conditions.

Period I (1912-1920)

During this first period the watersheds were maintained in their original condition by controlled grazing to determine the surface runoff and sediment production from a severely depleted watershed as compared to that from a watershed having a fair plant cover. In this period, Watershed A, with an average plant cover density of 16 percent, produced six times as much summer storm runoff and five times as much storm sediment as did Watershed B, which had an average plant cover density of 40 percent.

Period II (1921-1923)

Herbaceous cover on Watershed A was allowed to recover naturally by excluding grazing from 1920 through 1924. Over most of the watershed this recovery was quite rapid; the average plant cover increased from 16 percent in 1920 to 40 percent in 1924. However, some of the more severely depleted areas showed little or no improvement. During this recovery period Watershed A produced about three times as much summer storm surface runoff and sediment as Watershed B, about half as much as would have been expected had it remained in depleted condition.

Period III (1924-1930)

From 1924 to 1930, the average plant cover on both watersheds remained at about 40 percent. Even so, Watershed A still produced about twice as much summer storm runoff and sediment as B. This originated from areas on the watershed that had not recovered sufficiently to prevent excessive surface runoff and erosion. Plant cover distribution was more uniform on B than on A.

Results of the first three periods of this study were published by Forsling (*2*) and by Stewart and Forsling (*4*).

Period IV (1931-1945)

Because the two watersheds are somewhat dissimilar topographically, it was thought that the influence of herbaceous cover on surface runoff and erosion could be

defined more conclusively if treatments were reversed and the plant cover on Watershed B reduced while the plant cover on Watershed A was maintained at 40 percent. This reversal was effected during the fourth and fifth periods. In 1931, the cover on Watershed B was reduced to 30 percent and maintained at that density until 1942 by controlled grazing (Fig. 2*A*). As a result of this treatment, Watershed B produced 25 percent more summer storm runoff and 40 percent more sediment than Watershed A.

Period V (1946-1952)

Beginning in 1946, Watershed B was grazed heavily by sheep for 6 years (Fig. 2*B*). Plant cover was reduced to a degree of depletion comparable to that found on Watershed A in 1912. Watershed A was not grazed during this period and its average plant cover remained at 40 percent. As a consequence of this treatment, Watershed B produced 4½ times as much runoff and 12 times as much sediment as Watershed A. The reversal of cover conditions dramatically reversed surface runoff and sediment production, and showed conclusively the importance of sufficient plant cover for soil stabilization and flood control.

Period VI (1953-1958)

The primary objective during Period VI was to obtain quantitative information about the effects of artificial restoration on surface runoff and erosion. In October 1952, Watershed B was disked, a few small contour trenches were put in on the steeper slopes to prevent undue concentration of runoff, and the watershed was seeded with a mixture of adapted grasses by broadcasting 20 pounds of seed per acre.

This restoration treatment completely transformed the appearance of Watershed B. The gully system, previously so prominent, was broken up by disking and trenching. The following year grass seedlings were numerous throughout the watershed, and in 1954 a good stand of grass had become established on all but the poorest sites on the watershed (Fig. 2*C*). The effect of the treatment on surface runoff and erosion was also striking. Table 2 shows the magnitude of the surface runoff and erosion caused by summer storms on the experimental watersheds from 1951 through 1958.

Watershed A was not grazed during these years, and the variations in summer storm runoff and sediment production from this watershed from year to year are attributed primarily to variations in summer storm activity. Thus, yearly runoff and sediment production from Watershed A may be used as indices of summer storm severity during these years.

During the first growing season following restoration of Watershed B (1953), summer storm severity was the greatest recorded on the watersheds. Seeded grasses had not yet developed a cover adequate to control all runoff and erosion effectively, but the contour trenches provided the necessary additional control, and Watershed B produced only one-third as much surface runoff and one-tenth as much sediment as Watershed A. No summer storm runoff from Watershed B has occurred since 1953.

TABLE 1.—AVERAGE PLANT COVER DENSITY AND AVERAGE ANNUAL SUMMER STORM RUNOFF AND SEDIMENT PRODUCTION ON WATERSHEDS A AND B BY PERIODS, 1915 TO 1958

Period	Years	Average plant cover		Average annual summer storm runoff			Average annual summer storm sediment		
		A	B	A	B	Ratio A—B	A	B	Ratio A—B
		Percent		*Cu. ft. per A.*			*Cu. ft. per A.*		
I	1915-1920	16	40	913	153	6:1	134	25	5.4:1
II	1921-1923	30	40	922	260	3.5:1	105	37	2.8:1
III	1924-1930	40	40	362	171	2.1:1	24	10	2.4:1
IV	1931-1945	40	30	445	556	1:1.2	21	29	1:1.4
V	1946-1952	40	16	64	288	1:4.5	3	36	1:12
VI	1953-1958	40	30	292	92	3.2:1	10	1	10:1

TABLE 2.—SUMMER STORM RUNOFF AND SEDIMENT PRODUCTION FROM WATERSHEDS A AND B, 1951 THROUGH 1958

Year	Summer storm runoff		Summer storm sediment	
	Watershed A	Watershed B	Watershed A	Watershed B
	Cu. ft. per acre		*Cu. ft. per acre*	
	Watershed B depleted			
1951	63	396	3	102
1952	291	1,376	16	100
	Watershed B artificially restored			
1953	1,662	553	60	6
1954	0	0	0	0
1955	70	0	2	0
1956	0	0	0	0
1957	2	0	T	0
1958	17	0	T	0

Effects of Artificial Restoration On the Vegetation of Watershed B

Artificial restoration of Watershed B has increased the vegetation from a sparse stand of low-value broadleaf herbs to a fairly dense stand of palatable grasses (Table 3). Native broadleaf herbs dominated Watershed B prior to restoration and accounted for two-thirds of the total vegetation. Major species in order of abundance were: yarrow (*Achillea lanulosa*), bladderpod (*Lesquerella utahensis*), common dandelion (*Taraxacum officinale*), false carrot (*Pseudocymopterus montanus*), Rydberg penstemon (*Penstemon rydbergii*), and sweetsage (*Artemisia discolor*). Restoration reduced the abundance of all these species except sweetsage; its abundance has not changed and it is now the

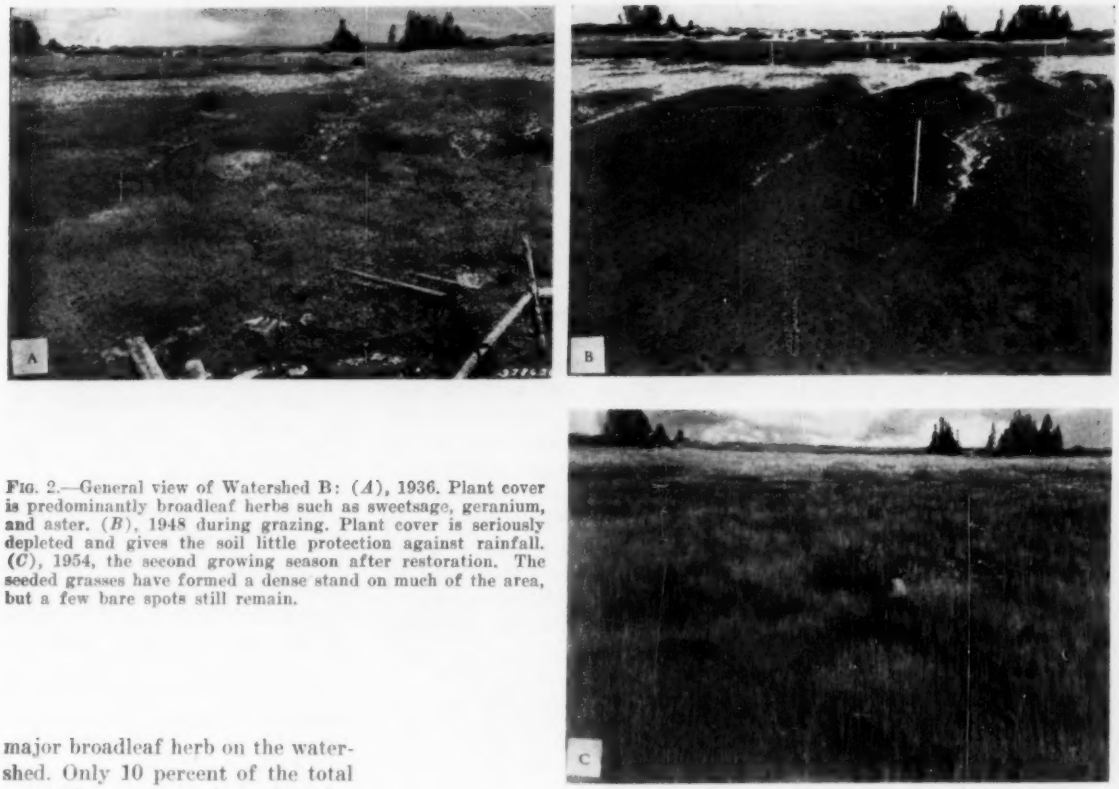


FIG. 2.—General view of Watershed B: (*A*), 1936. Plant cover is predominantly broadleaf herbs such as sweetsage, geranium, and aster. (*B*), 1948 during grazing. Plant cover is seriously depleted and gives the soil little protection against rainfall. (*C*), 1954, the second growing season after restoration. The seeded grasses have formed a dense stand on much of the area, but a few bare spots still remain.

major broadleaf herb on the watershed. Only 10 percent of the total vegetation now consists of native broadleaf herbs.

Unlike the native broadleaf herbs, the native grasses have increased since restoration. Slender wheatgrass (*Agropyron trachycaulum*) and Letterman needlegrass (*Stipa lettermanni*), the dominant grasses before restoration, have increased markedly and now constitute 30 percent of the total vegetation. Disking aided the establishment of these grasses by reducing competition and by mixing the seed into the soil.

Seeded grasses dominate the vegetation following restoration. In order of abundance, the major grasses are: smooth brome (*Bromus inermis*), meadow foxtail (*Alopecurus pratensis*), orchardgrass (*Dactylis glomerata*), mountain brome (*B. carinatus*), and meadow brome (*B. erectus*). Smooth brome, a sodformer, is the most abundant and is expected to increase. The other seeded grasses are bunchgrasses, which usually develop more rapidly than smooth brome and provide needed cover during the first few years. The bunchgrasses are gradually being reduced by competition but may remain as important components in some spots where rhizomatous grasses did not become established or do not succeed.

Nomad alfalfa (*Medicago sativa*), mountain lupine (*Lupinus alpestris*), and chickpea milkvetch (*Astragalus cicer*) were spot-seeded on some of the more severely depleted portions on the lower part of Watershed B. These legumes provide some cover on areas that otherwise would be virtually bare because the seeded grasses failed to develop on these harsh sites.

Litter

Litter cover was first estimated on these watersheds in 1951. Earlier surveys had disregarded this important component of ground cover. The cover densities shown in Table 1 are live plant cover only. Table 3 shows the litter cover for the 3 years in which it was measured. It represents the litter on areas not covered by live plants.

Watershed B, with its high percentage of grasses coupled with the exclusion of grazing, is producing large amounts of litter. Watershed A, which has not been grazed appreciably since 1919, has only about half as much litter. Quick disintegration and decomposition of the less fibrous litter produced by broadleaf herbs, which make up the bulk of the vegetation on Watershed A, are responsible for this difference.

The importance of live plant cover in preventing damaging surface runoff has been definitely established by the A-B Watershed study. Although the importance of litter is less well known, infiltrometer tests on these watersheds, as well as on other areas, show that litter cover is probably as important as live plant cover in preventing runoff and erosion.

TABLE 3.—POINT DENSITY ESTIMATES OF GRASS, BROADLEAF HERBS, BRUSH, AND LITTER ON WATERSHEDS A AND B IN 1951, 1957, AND 1958

	Watershed A			Watershed B		
	1951	1957	1958	1951	1957	1958
	Percent					
Grass	8.6	7.6	6.0	3.1	28.6	20.9
Broadleaf herb	32.1	29.1	27.9	9.2	5.1	3.6
Brush	3.2	3.4	3.3	1.2	.3	.5
Total live plant cover	43.9	40.1	37.1	13.5	32.2	25.0
Exposed litter	11.8	16.0	16.8	5.8	27.8	31.4
Total ground cover	55.7	56.1	54.0	19.3	60.0	56.4

Discussion

Exclusion of grazing from depleted Watershed A resulted in rapid increase in the amount of plant cover on most parts of the watershed and a substantial reduction in runoff and sediment production. After the initial rapid recovery in the early years, no significant increase in average plant cover has occurred. The more depleted areas on Watershed A did not respond appreciably to grazing exclusion (Fig. 1*B*) and, although they have been improving gradually, they still produce surface runoff during the more intense summer storms.

Heavy grazing on Watershed B changed a fairly stable watershed into a serious flood-source area. Erosion that occurred because of this plant cover depletion reduced productivity of some parts of the watershed to the extent that they will no longer support as much plant cover as they did before depletion.

Restoration of Watershed B provided almost immediate control of surface runoff and sediment production. During the summer following restoration, control of surface runoff was achieved largely by the contour trenches because the seeded grasses were still developing and did not provide adequate cover. By 1954, the second year after seeding, a good stand of grass was established on all but the poorest sites. Since 1954, the trenches have been necessary for control of surface runoff only on the few areas where low soil productivity prevented the establishment of adequate plant cover. Plant cover on these poor sites is gradually improving. The presence of seeded legumes on some of these harsh sites is expected to hasten their improvement.

In general, flood-source areas cannot be satisfactorily restored by grazing exclusion alone. Erosion reduces the fertility and moisture storage capacity of the soil mantle to the point that, even with permanent exclusion of grazing, plant cover adequate to prevent excessive runoff and erosion cannot develop by natural means. This has been demonstrated on Watershed A. Thus, additional control measures are usually needed.

Contour trenching and seeding restored the stability of Watershed B. Seeded grasses with their high litter production provide adequate cover on almost all of the watershed, and contour trenches, by checking surface runoff and erosion, prevent further deterioration of the portions that do not support an adequate cover. Seeded grasses and legumes are more effective in restoring productivity of poor sites than are native broadleaf herbs that would normally occupy these sites. If properly managed, many of these sites will eventually support an adequate plant cover.

Restoration of Watershed B has had the additional benefit of reclaiming it for usable livestock range. Watershed A is still in marginal condition and would deteriorate if subjected to more than light grazing. Although it has not been grazed since it was restored, Watershed B now appears stable enough to support some degree of controlled grazing. This phase of the study will be investigated within the next few years.

Literature Cited

1. ELLISON, LINCOLN. 1954. Subalpine vegetation of the Wasatch Plateau, Utah. Ecol. Monog. 24:89-184.
2. FORSLING, C. L. 1931. A study of the influence of herbaceous plant cover on surface runoff and soil erosion in relation to grazing on the Wasatch Plateau in Utah. U. S. Dept. Agric. Tech. Bul. 220. 71 pp. Illus.
3. LEVY, E. B., and E. A. MADDEN. 1933. The point method of pasture analysis. New Zealand Jour. Agr. 46:267-279.
4. STEWART, GEORGE, and C. L. FORSLING. 1931. Surface runoff and erosion in relation to soil and plant cover on high grazing lands of central Utah. Jour. Amer. Soc. Agron. 23:815-832.

Notes and Observations

Height Growth Pattern and Thinning of Slash Pine (Pinus elliottii var. elliottii)

The density at which to thin slash pine (*Pinus elliottii* var. *elliottii*) is always a problem because stand reaction to release has not been measured. Foresters have assumed that almost without exception slash pine responds to release. The idea that to thin is to increase diameter growth, and that the heavier the thinning the greater the response, up to a point, is generally accepted for our slash pine stands under 50 years of age. However, inspection of the height growth pattern of the species brings to focus a point usually overlooked.

Table 1 outlines the average height of the dominant stand by age and site class through age 60. These values were read from site index curves constructed from data taken on the George Walton Experimental Forest, Dooly County, Ga. Reading from site 70, the dominant trees averaged 2.1 feet annually in height growth for the first 25 years, while during the second 25 years, the average was 0.7 foot per year. Further, the average for the period from 35 to 50 years was 0.4 foot per year. Table 2 illustrates the average annual height growth by 5-year periods from 20 through 60 years for the various site classes.

These data point up the fact that after a certain age, crown length cannot be appreciably increased through additional height growth. This in turn means that the crown ratio percent cannot be materially increased by release. Table 3 outlines the crown ratio increase to expect at various ages as a result of thinning and added height growth. These figures are based on the assumption that release will be sufficient to prevent further loss at the base of the crown during the period involved. The data are not presented by individual site classes because the percentage crown ratio increase varies little between sites. It is evident from Table 3 and Figure 1 that a marked build up in crown ratio percent, as a result of thinning, is possible only during the period of reasonable height growth. Up to age 30 the response to thinning in crown ratio increase is good, but after age 30, and most especially after age 35, the response is negligible.

Other than by height growth, crown area may increase through lateral growth or a change in crown shape. However, it is obvious that lateral growth, even when non restricted, is less than and assumes a pattern similar to that of terminal growth; i.e., a definite reduction with age. For instance, on 50-year-old open grown slash pine, crown width is considerably less than tree height. If lateral growth did not reduce with age, crown diameter on the older open grown trees might equal or exceed tree height. Also, the theory of apical dominance seems well established, further reducing the chance that lateral growth might exceed height growth

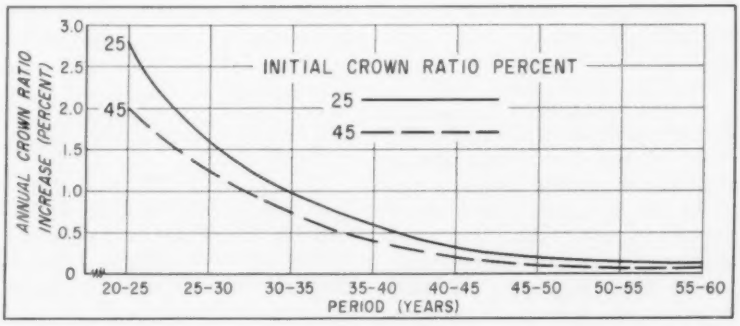


FIG. 1.—Periodic annual increase in crown ratio percent after thinning at initial crown ratios of 25 and 45 percent.

TABLE 1.—HEIGHT OF SLASH PINE AT VARIOUS AGES ON VARIOUS SITES

Age	Site index class 40	50	60	70	80	90
	Feet					
20	25.0	31.5	37.5	44.0	50.5	57.0
25	30.0	38.0	46.0	53.5	61.25	69.0
30	34.0	43.0	51.5	60.0	68.75	77.0
35	36.5	45.5	55.0	64.0	73.25	82.5
40	38.0	47.5	57.5	67.5	77.0	87.0
45	39.25	49.0	59.0	69.0	79.0	89.0
50	40.0	50.0	60.0	70.0	80.0	90.0
55	40.25	50.5	60.5	70.5	80.75	91.0
60	40.5	50.75	61.0	71.0	81.25	91.5

TABLE 2.—PERIODIC ANNUAL HEIGHT GROWTH OF THE DOMINANT SLASH PINE STAND ON VARIOUS SITES

Age period	Annual height growth by site index class 40	50	60	70	80	90
	Feet					
20-25	1.0	1.3	1.7	1.9	2.2	2.4
25-30	0.8	1.0	1.1	1.3	1.5	1.6
30-35	0.5	0.5	0.7	0.8	0.9	1.1
35-40	0.3	0.4	0.5	0.7	0.7	0.9
40-45	0.2	0.3	0.3	0.3	0.4	0.4
45-50	0.15	0.2	0.2	0.2	0.2	0.2
50-55	0.05	0.10	0.10	0.10	0.15	0.20
55-60	0.05	0.05	0.10	0.10	0.10	0.10

TABLE 3.—THE EFFECT OF AGE AND THINNING ON CROWN RATIO PERCENT

Age when thinned	Crown ratio when thinned	Crown ratio at age —								
		25	30	35	40	45	50	55	60	65
	Percent					*Percent*				
	25	38.2	44.9							
	30	42.3	48.6							
20	35	46.4	52.3							
	40	50.5	55.9							
	45	54.6	59.6							
	25		33.2	37.3						
	30		37.6	41.5						
25	35		42.1	45.6						
	40		46.5	49.8						
	45		51.0	54.0						
	25			29.6	33.0					
	30			34.3	37.5					
30	35			39.0	42.0					
	40			43.7	46.4					
	45			48.4	50.9					
	25				28.6	30.4				
	30				33.4	35.1				
35	35				38.2	39.7				
	40				42.9	44.4				
	45				47.7	49.0				
	25					26.9	27.8			
	30					31.8	32.6			
40	35					36.1	37.4			
	40					41.5	42.2			
	45					46.4	47.1			
	25						25.9	26.6		
	30						29.6	31.5		
45	35						35.8	36.4		
	40						40.7	41.3		
	45						45.7	46.2		
	25							25.7	26.1	
	30							30.6	31.1	
50	35							35.6	36.0	
	40							40.5	40.9	
	45							45.5	45.8	
	25								25.5	25.9
	30								30.4	30.8
55	35								35.4	35.8
	40								40.4	40.7
	45								45.3	45.7

at any age.[1] As to the geometric shape of the crown, any change that may occur will likely be previous to the period of limited height growth. During the younger years the shape may change from a cone to the characteristic paraboloid of later years. However, observations indicate that even on young slash pine only a small portion of the crowns are cones rather than parabolas. A "flattened" top comes, of course, with overmaturity.

Thus, the opportunity for increasing crown area during the period of restricted height growth is definitely limited. Crown density and needle length may increase slightly after release, but crown length will be practically static and crown diameter will not increase greatly.

If crown area (the food manufacturing plant) cannot be effectively increased, diameter growth can be stimulated by thinning only through a reduction in competition for moisture and nutritive elements and/or through increased photosynthetic activity as a result of added light. However, the chances for increased photosynthesis will be limited, for we are dealing only with the dominant stand, which by definition receives, before release, some light from the sides and full light from above. Certainly, if we enter the period of reduced height growth with a low crown ratio percent (25-30 percent), the opportunity for improving diameter growth will be strictly limited, for when working at peak efficiency, the output from a crown of this size cannot be overly abundant. In essence, the data presented in Table 3 and Figure 1 suggest the net result of thinning at age 35 and over will be little if any more than maintenance of the established diameter growth rate. The indications are that we should enter this period of limited height growth with the amount of crown deemed necessary for the desired diameter growth rate because there will be little chance to build additional crown.

The ideas expressed here concerning the relationship of crown area to age and thinning do not provide basic information on growth, but they do point out some results to expect. A measure of diameter growth in relation to crown ratio percent under various age and site conditions is needed to quantitatively express stand reaction to thinning. Stand density studies being conducted by the Southeastern Forest Experiment Station in both natural and planted slash pine stands will help solve these relationships, but these studies are of rotation length and final results are years away.

FRANK A. BENNETT
Southeastern Forest Experiment Station, Forest Service, U. S. Department of Agriculture, Cordele, Ga.

[1]Miller, Edwin C. Plant physiology. New York. 1938.

Use Of A Military Flame Thrower To Open Cones In Standing Jack Pines

The serotinous or closed-cone habit of jack pine (*Pinus banksiana* Lamb.) has restricted natural regeneration of the species in many parts of its range. Coincident with studies of prescribed fire in the jack pine type of northern Michigan,[1] alternative methods

[1]These studies were conducted by the author as part of a cooperative project by the Forestry Division, Michigan Department of Conservation, and the School of Natural Resources, University of Michigan.

were tested to induce the resin-sealed cones to release their seeds. Among these was torching the crowns of standing seed trees with an M2A1 portable flame thrower. This device may be used under circumstances where broadcast burning is too hazardous or is otherwise unsuitable as a silvicultural tool.

The test was conducted near Oscoda, Mich., while snow covered the ground and air temperature averaged 5° F. The flame thrower was charged with equal volumes of waste crankcase oil and automotive gasoline. Initial tank pressure was 2,000 pounds per square inch.

An ignited stream of this heavy fuel was directed at the crowns of several standing jack pine trees containing closed cones. A four-second blast was required to open cones at a height of 50 feet above the ground. Since the fuel in the flame thrower lasts about nine seconds, two trees could be treated with each filling.

Needles on the trees were scorched and covered with soot. However, the treatment need not necessarily kill trees, since new vegetative buds are not seriously damaged when treatment is conducted in the winter.

Seeds from cones opened by the flame thrower were germinated in petri dishes containing moist filter paper. Total germination percentage was normal, demonstrating that the seeds were not harmed by the fire.

Although use of the flame thrower cannot be recommended as an economic expedient, adaptation of this or similar devices might occasionally be useful when combined with prior site scarification. This would be especially true on areas containing scattered, open-grown wolf trees, where forest values are exceptionally high, or where broadcast burning of slash is too dangerous.

WILLIAM R. BEAUFAIT
Ford Forestry Center, Michigan College of Mining and Technology, Houghton

Pole Steps for Climbing Trees

Climbing on conifers of moderate size can be made relatively convenient and safe by the use of screwed-in telephone-pole steps.

In April 1955 an average of 13 pole-steps were inserted into each of 2 slash and 4 longleaf pine trees (d.b.h. 9 to 11 inches) on the Harrison Experimental Forest in south Mississippi. The steps were placed at two-foot intervals on alternate sides of the tree starting at 12 feet above the ground and extending to where a climber could reach live branches without difficulty. The high placement of the first step was calculated to give some discouragement to young boys, though it necessitated using the base section of a Swedish ladder to start climbing the tree.

The steps were 5/8-inch in diameter and 10 inches long. They cost 27¢ each. To install a step, a hole ½-inch in diameter and 3 inches deep was first bored with a brace and bit. The step was driven in the first inch with a hammer and screwed in the last two inches with a wrench. Boring was done by hand, but a portable electric generator and a power drill would save much labor. Following installation, the trunk of the tree was sprayed to above the highest step with a 0.5 percent emulsifiable benzene hexachloride solution as a protection against bark beetles. This was the only time the trees were sprayed.

In 1958, the steps were backed out from three to six turns, depending upon the growth rate of the tree. No gum exudation was observed.

The people using these steps feel that they are worth while on trees that must be climbed repeatedly or that are so far from roads that ladders must be carried for considerable distances. There seems to be no biological or insurmountable mechanical obstacle to their use if some reasonable precautions, such as spraying, are employed.

R. M. ALLEN
Southern Institute of Forest Genetics, Southern Forest Experiment Station, Forest Service, U. S. Department of Agriculture, New Orleans, La.

Sprouting Capacity of Scrub Oak

Pennsylvania foresters have been searching for a practical means of converting the scrub oak (*Quercus ilicifolia* Wang.) areas of the state to more productive timber types for over 45 years. The first project of this type was initiated on Nittany Mountain in Clinton County in 1911 by the Department of Forests and Waters.

This search is still being carried on in Pennsylvania and since 1948 experiments and studies have been greatly accelerated on the Delaware-Lehigh Experimental Forest in Monroe County.

Scrub oak flourishes on the poorest of sites. It is usually the first woody plant to grow upon burned-over areas and can fully develop on very acid and infertile soils. Its ability to resprout vigorously after burning or cutting permits it to attain densities of 50,000 to 100,000 stems per acre.

The economical control or eradication of this species poses just as much of a problem today as it did when the first attempts were made to effect a reasonable control. The statewide problem, however, is not as acute since the total area covered by scrub oak is being reduced each year through natural succession of plants following successful extended periods of fire protection.

In an effort to see what effect continuous cuttings would have on the vitality and longevity of scrub oak a small scale study was initiated on the experimental forest during August 1951. Two 25-foot square plots were laid out in the scrub oak type. The plan to be followed consisted of clearcutting the scrub oak sprouts in July and September

TABLE 1.—ERADICATION OF SCRUB OAK BY SEMIANNUAL CUTTING

Date cut	Plot A 25 ft. × 25 ft Average height	Plot A 25 ft. × 25 ft Time required	Plot B 25 ft. × 25 feet Average height	Plot B 25 ft. × 25 feet Time required
	Feet	*Man-hours*	*Feet*	*Man-hours*
Aug. 31, 1951	5.0	0.75	3.0	0.50
June 27, 1952	2.9	0.16	1.8	0.13
Sept. 18, 1952	1.7	0.42	2.0	0.25
July 3, 1953	2.0	0.50	2.0	0.16
Sept. 8, 1953	1.5	0.33	1.5	0.11
July 2, 1954	1.7	0.33	1.7	0.16
Sept. 27, 1954	0.9	0.23	0.8	0.08
July 5, 1955	1.6	0.16	1.2	0.08
Sept. 14, 1955	1.0	0.10	1.1	0.03
July 3, 1956	1.2	0.06	0.6	0.01
Sept. 21, 1956	0.7	0.03	0.4	0.01
July 8, 1957	0.8	0.05	—	—
Sept. 1957	—	—	—	—

of each year until sprouting no longer took place.

The theory behind this study was to cut the vegetation during the period when the plants were manufacturing food for storage to be used when growth began during the following spring. At that time, during June or early July, the sprouts would be cut again before there was sufficient time to manufacture new food. Theoretically, this method should kill the plants rather quickly. In the case of scrub oak this was not the case. It was necessary to cut the scrub oak 12 times before sprouting was stopped.

Table 1 shows recorded heights and time required to cut each plot for the entire operation. All cut brush was removed from the plots.

E. F. MCNAMARA
District Forester,
Pennsylvania Department of Forests and Waters,
Stroudsburg

Herbage Production Is Related to Hardwood Crown Cover

It is well known that herbage production increases as forest crown cover decreases. This is notably true in low-grade hardwood stands in the Missouri Ozarks. An experiment, begun in 1957 to further study this relation, shows that most of the herbage increase comes when tree-crown cover is reduced below 50 percent.

Study Area and Procedure

The study was made in Dent County about 10 miles east of Salem, Mo., on rolling land with moderate slopes. The soil is a Clarksville stony loam with a surface that consists mainly of cherty stones with a light leaf litter.

Forest cover in the area is primarily blackjack oak (*Quercus marilandica*) and post oak (*Quercus stellata*) with some black oak (*Quercus velutina*), hickory (*Carya* spp.), sassafras (*Sassafras albidum*), and other hardwood species. Herbage on the study area consisted mostly of native prairie grasses such as little bluestem (*Andropogon scoparius*), Indiangrass (*Sorghastrum nutans*), switchgrass (*Panicum virgatum*),

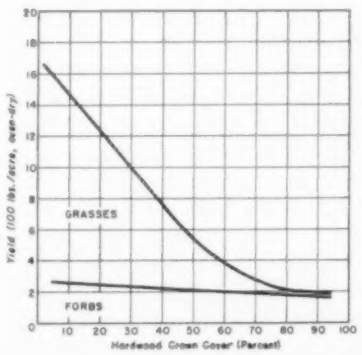


FIG. 1.—Herbage production decreases as hardwood crown cover increases.

and forbs such as goatsrue (*Tephrosia virginiana*), pussytoes (*Antennaria plantaginifolia*), and goldenrod (*Solidago* spp.).

Twenty-seven rod-square plots were randomly selected under various densities of hardwood crown canopies. Herbage yield (clipping to a height of 1 inch) and composition were measured on four randomly selected 2.4 square-foot quadrats in each rod-square plot. Percentage of ground shaded by trees was based on 40 observations on each rod-square plot.

Results and Discussion

Cleared areas produced more than 1,700 pounds of oven-dry herbage per acre whereas dense stands (80 percent or more crown cover) produced only 250 pounds per acre (Fig. 1). Grasses accounted for practically all of the increase in total herbage production as percentage crown cover decreased.

The increase in grass production was small per unit reduction in crown cover from 80 to 50 percent, but with successive decreases from 50 percent crown cover to none there were relatively large increases in grass production. Increases in forb production with decreases in crown cover were small and constant from the dense hardwood canopies to cleared areas.

Species responded differently to changes in hardwood crown cover. Little bluestem, broomsedge (*Andropogon virginicus*), switchgrass, and Indiangrass were scarce in stands of dense crown canopy and persisted only as spindly, low-vigor plants. But as hardwood crown cover decreased they increased greatly in both number and vigor. Poverty oat grass (*Danthonia spicata*) on the other hand was more

abundant under dense canopies and decreased as crown cover decreased and ground cover increased. Little bluestem was the most abundant grass on the area. On areas of 30 percent crown cover or less, it contributed about two-thirds of the total herbage yield.

One unpalatable forb, goatsrue (which yielded more than all other forbs combined), produced about the same quantity of herbage under all densities of hardwood crown cover. Yield of most forbs, such as partridge pea, fireweed, aster, sunflower, and goldenrod, increased as crown cover decreased, although some forbs such as pussytoes and the smaller desmodiums and lespedezas decreased as crown cover decreased.

The results show that when thinning hardwood forests to obtain more forage, stands should be thinned to well below 50 percent crown cover in order to obtain a large increase in herbaceous plant production.

JOHN H. EHRENREICH
and JOHN S. CROSBY
Central States Forest Expt. Sta., Forest Service, U. S. Dept. Agric., Columbia (Mo.) Forest Research Center, maintained in cooperation with the University of Missouri Agric. Expt. Sta.

Contour Interpolator

For certain types of topographical surveys contours are often interpolated between points of known elevation. Among other things, the validity of contours located by interpolation depends on the assumption that the slope between adjacent points of known elevation is uniform.

In locating contours on a map by interpolation, the position of points on the contour can be determined mathematically or graphically. Mathematical interpolation is rigorously precise and straightforward. However, it is arithmetically laborious—so, seldom used.

The graphical or mechanical method of contour point location depends on the application of the geometric principle of the proportional division of a line into any number of equal parts.

Illustrated in Figure 1 is an inexpensive, easy-to-use device for the rapid and precise graphical solution of contour point locations between two points of known elevation. It can be constructed from an inexpensive slide rule, with any convenient decimal scale affixed to the slide. A metal ferrule with a registration point is fixed to one end of the rule, and a second sliding metal ferrule with a pivoting spring steel arm, as illustrated, is fitted over the body of the rule. The pivoting arm is so fixed that friction will hold it at any desired setting.

The application of this instrument is simple. For example, to plot contour point location on a two-foot contour interval between two points whose elevations are 2.7 and 8.1 feet, respectively, the procedure would be as follows:

1. A line is drawn joining the two points.
2. The 2.7 graduation on the instument slide is brought into coincidence with the index edge of the fixed ferrule.
3. The recessed index edge of the sliding ferrule is brought into coincidence with the 8.1 graduation on the instrument slide.
4. The instrument is placed on the map, as illustrated, with the index point of the fixed ferrule placed on the point of 2.7 feet elevation.
5. Then the pivoting arm is rotated until its index edge is registered over the point of 8.1 feet elevation.
6. While keeping the rule stationery, and maintaining the fixed angle between the rule and pivoting arm, the recessed index edge of the sliding ferrule is placed successively in coincidence with 8.0,

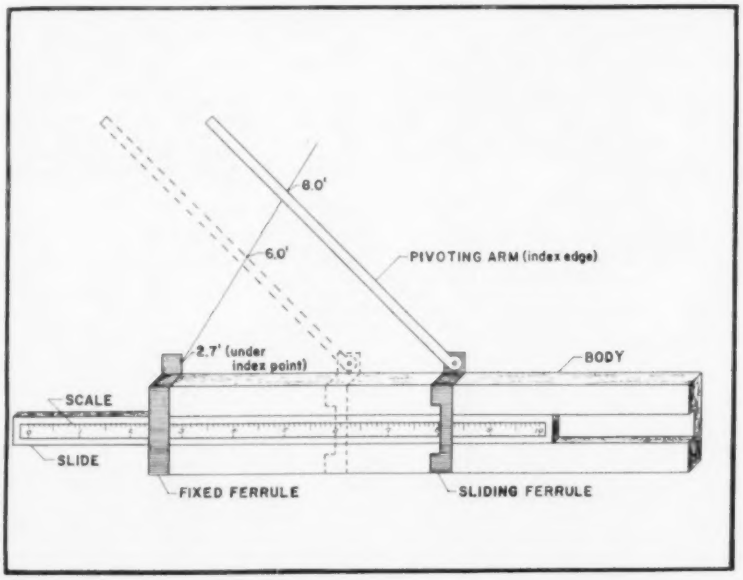


FIG. 1.—Contour interpolator.

6.0, and 4.0. The respective contour points are marked where the index edge of the pivoting arm intersects the line joining the two points of known elevation. The sliding ferrule and pivoting arm are shown by dashed lines in position to mark the 6.0 contour point. Note that the contour points can be located with greater precision if, in setting up, the pivoting arm can be positioned approximately perpendicular to the line joining the two points of known elevation.

While the instrument was designed for contour interpolation, it can be adapted to any situation where it is necessary to graphically proportion a line into some predetermined number of parts.

JAMES W. SMITH
Woodlands Division,
Union Bag-Camp Paper Corp.,
Savannah, Ga.

An Improved Jacob Staff Point

All who have had the frustrating experience of trying to seat a Jacob staff firmly in hard, dry clay will appreciate the Jacob staff point described and illustrated here.

The point assembly is made of stainless steel for longer service life. Stainless steel can be obtained at most machine and foundry companies, pipe and steel companies, or hardware stores. Welding of this material is done by electric welding with stainless steel welding rods. Oxygen acetylene welding using ⅛ inch or 5/64 inch stainless steel wire for welding rods can be used also. For a "second best" material, 3/8 inch cold roll steel is used for the spike, the sleeve is cut from a piece of water pipe, and the plate from a piece of ⅛ inch flat iron. The sleeve and plate are painted to inhibit rust.

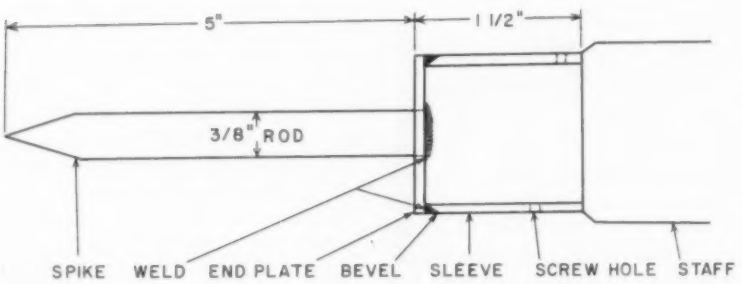


FIG. 1.—Illustration of improved Jacob staff point.

As all Jacob staffs are not of the same diameter, the piece of material selected for the sleeve is slightly smaller in diameter than the staff. The staff is then trimmed down to give a tight fit. The sleeve is cut 1½ inches in length and one end beveled for welding. The end plate is cut with a diameter equal to the outside diameter of the sleeve and a ⅜ inch hole is drilled for the spike. The spike is made of ⅜ inch × 5 inch round material. The spike is welded to the end plate on the inside and the plate is welded to the sleeve on the outside, the weld being in the beveled joint. The spike is now turned down to a point and the sleeve and plate are dressed down for a smooth finish. Two holes are drilled in the sleeve in order to secure the sleeve to the staff with screws.

BUDDY RAY HUMPHREY
Class of 1960, School of Forestry,
Mississippi State University,
State College

Points of View

What Is the Trend in Lumber Prices?

We can confirm the principal finding reported in T. A. McClay's recent article[1] on seasonal fluctuations in ponderosa pine lumber prices. By a simpler analysis early in 1958, we found that there is no fixed pattern to the movement of price indexes for ponderosa pine, sugar pine, white fir and Douglas-fir.[2]

However, an observation made by McClay in his summary deserves closer examination to disclose its probable significance. The purpose of this note is to provide a part of that examination.

"An analysis of variance revealed significant upward trends in prices," declared McClay. Does this really mean, as it implies to the average forester, that ponderosa pine prices are moving strongly upward, perhaps at a greater rate than the prices of other competitive products?

The 20-year period under study began in the great depression and ended four years ago at an apparent high point in pine prices. Is there any product on the market today that has not shown a significant upward trend in price since the mid-thirties? If there is not, the pine price trend may signify only that pine prices have not moved completely contrary to prices in general since the depression.

To give the long-term trend of ponderosa pine lumber prices more meaning, we can eliminate the effect of inflation. Further, we can compare it with competitive building materials and with some of the lumber-production-cost factors.

Many of our problems require a short-term trend indicator. That which has been happening in recent years may be a better indicator of what may happen next year than the long-term trend line.

For these reasons, the accompanying table and chart were prepared to illustrate trends during this decade. The ponderosa pine price index (1933 basis) is given with wholesale price indexes from the U. S. Bureau of Labor Statistics. Lumber's competitors, "nonmetallic minerals, structural," "nonferrous metals," and "iron and steel," are included.

Of course, steel is also a cost factor in lumber production, as are the costs of "construction machinery and equipment" (for logging), "petroleum and products," and "tires and tubes." All indexes were deflated by being placed on a com-

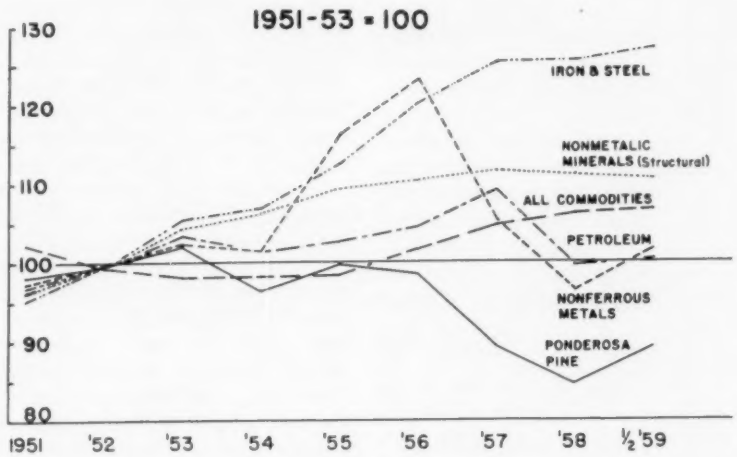


FIG. 1.—Price indexes on constant dollars.

[1]McClay, T. A. Seasonal fluctuations in ponderosa pine lumber prices. Jour. Forestry 57:644-647. 1959.

[2]Craig, G. A. Variation in W.P.A. price index with season. Western Lumber Manufacturers, Inc. Mimeo No. 137. February 21, 1958.

TABLE 1.—WHOLESALE COMMODITY PRICE INDEXES IN CONSTANT DOLLARS

(1951-1953=100)

	1951	1952	1953	1954	1955	1956	1957	1958	1959[1]
Ponderosa pine price	98.24	99.69	102.07	96.40	99.87	98.82	89.63	84.84	89.18
All commodity prices	102.34	99.49	98.15	98.33	98.68	101.89	104.84	106.26	106.71
Nonmetallic minerals (structural)	96.34	99.11	104.52	106.72	109.24	110.39	111.63	111.03	110.69
Nonferrous metals	97.61	99.85	102.52	101.60	116.31	123.23	105.47	96.66	101.82
Iron & steel	95.22	99.14	105.62	106.91	112.69	120.09	125.43	125.68	127.11
Construction machinery & equipment	95.71	99.89	104.40	106.07	110.09	115.57	120.84	124.02	127.52
Petroleum & products	97.36	99.06	103.55	101.61	102.98	104.61	109.26	99.87	100.05
Tires & tubes	100.41	100.12	99.46	101.93	112.69	114.63	110.44	110.06	109.02

[1]Based on first half of 1959.

Source: Western Pine Association; U. S. Bureau of Labor Statistics.

mon-dollar base through use of the BLS "all commodities" wholesale price index, which also is graphed.

From all of this, we might conclude that during this decade there has been a significant downward trend in ponderosa pine lumber prices when compared to wholesale prices in general and competitive-commodity and cost-item prices in particular.

GEORGE A. CRAIG
Western Lumber Manufacturers, Inc., San Francisco, Calif.

As a Matter of Information

In spite of the increased emphasis on licensing of foresters in the various states, the articles in the JOURNAL OF FORESTRY, the discussions at Chapter and Section meetings, and the papers presented at the annual SAF meetings, there is apparently a large amount of misinformation concerning licensing among foresters. Some of this misinformation may possibly be lack of information. A case in point is the article by Henry I. Baldwin in the Points of View section of the April, 1960, JOURNAL OF FORESTRY.

Mr. Baldwin states: "Apparently there are two purposes that the sponsors of licensing have in mind: (1) to protect the public from incompetence, and foresters from competition of nonforesters doing forestry work, and (2) to enhance the 'professional' standing of graduate foresters." Mr. Baldwin has numbered only two purposes, but has included three.

With the first listed purpose: "to protect the public from incompetence," none will disagree. All licensing of foresters has one fundamental purpose: *for the benefit and protection of the general public.* No other purpose is stated in any present forester licensing law, and it is doubtful if any will be in the future.

Also, none disagree with the statement that the "standing" of the forester is enhanced by licensing, but no such purpose is stated in any of the licensing laws. It is also doubtful if this sort of selfish thinking was ever in the minds of those who have proposed licensing in the various states. Most foresters are altruistic and have a sense of public responsibility far beyond the average. Those not in this category are the most outstanding examples of the need for licensing.

It has also been suggested that sponsors of licensing legislation have in mind the need to protect foresters from nonforesters doing forestry work. Few foresters feel that they need such "protection." Again, however, there is a definite need to protect the *public* from these same nonforesters. There is no question as to the validity of this statement in those sections of the United States where forestry has outgrown the textbook category and is being practiced in the woods. There are few, if any, foresters in the three states where licensing of foresters is a fact, or in other states where it is being strongly advocated, who are so naive as to believe that licensing is not needed to protect the public from the untrained, or poorly trained, practitioner.

There also seems to be a misunderstanding, or misinformation, concerning the examination required of some before the license is granted. In Georgia (which Mr. Baldwin used as example) the examination is not designed to examine only the candidate's forestry techniques, but also his grasp of fundamental forestry principles. Only three nonforesters (or technicians) have passed the Georgia examination in the past nine years, which is fair evidence that it is not designed to examine candidates only on their ability as technicians.

Mr. Baldwin asks if licensing can include the code of ethics. In the Georgia application for licensing, the candidate is required to swear that he subscribes to, and agrees to conform to, the Code of Ethics. Failure to conform after licensing leads to revocation of the license.

Few will disagree with Mr. Baldwin that many foresters do subprofessional work. In a greater or less degree the same is true of all professions, depending largely upon the age of the profession, and the availability of both technicians and professionals in any one place at any one time. Not too long ago the doctors of medicine prepared their own prescriptions, some still do; many lawyers today prepare their own briefs; pharmacists sell medicines by trade name; and foresters cruise and mark timber. We all must crawl before we walk, and walk before we run. But surely no one will subscribe to the tenet that professional foresters should not be trained and tested in the techniques of forestry. Forestry, as a profession, is progressing in the United States. As it progresses it meets new problems, many of which cannot be solved by old methods or satisfied by old answers. New methods are needed, and licensing has proven itself in the older, more firmly established professions. Should we cast aside the proven experiences of others?

We are not living in the world of 1900, either as individuals or as a profession. The idealism that was embraced by the seven men who formed the Society of American Foresters, and the eight who were elected to membership two days later, is scarcely to be expected to exist *in the same form* in the 14 to 15 thousand foresters in the United States today. The feeling still exists, but is expressed in a different manner, i.e., by *protecting the public* with a system of self-imposed state licensing.

ARCHIE E. PATTERSON
Chairman, National Committee on Licensing and Registration, SAF

Book Reviews

Mineral Nutrition of Trees

Duke University School of Forestry Bulletin 15. 184 pp. Illus. Durham, N. C. 1959. $2.50.

A symposium on forest tree nutrition was called at Duke University in December, 1958, in response to a growing interest in forest fertilization and the corresponding need for greater insight into the problems of tree nutrition research. This bulletin contains the papers presented.

The horticulturists, botanists, agronomists, and foresters who participated in the symposium are all qualified in some aspect of plant nutrition. In discussing past results and present status of work in this field, they attempted to provide insight as to the direction in which research in forest-tree nutrition might proceed in the future.

H. L. Barrows, N. R. Childers, J. C. Cain, K. C. Beeson, G. Stanford, W. E. Ballinger, and E. T. York, drawing upon years of research with such crops as tung, apples, and clover, condense and relate their own experiences to forestry thinking. Foliar and soil analyses are discussed in simple theory, and recommendations are made for using them in forestry. The merits of surveys, laboratory experiments, and field experiments are touched upon. Differences in problems of fertilizing forest trees versus fertilizing other crops are not always appreciated; nevertheless, the similarities in problems outweigh the differences. Nowhere else, to the reviewer's knowledge, has there been an attempt on this scale to interpret orchard and field crop experience for foresters.

The papers of P. J. Kramer, H. J. Evans, and N. S. Hall cover some of the more fundamental problems of physiology and soil science that confront and challenge the researcher in mineral nutrition of forest trees.

H. A. Fowells, R. L. Barnes, and E. Hacskaylo discuss approaches already used in forestry. Their papers help introduce the newcomer to some of the work that has already been done with forest trees in field trials, sand cultures, root cultures, and mycorrhizal studies. Most of this information has been published elsewhere in greater detail.

Papers by W. T. Doolittle, J. W. Johnson, and M. B. Applequist, who surveyed the status, scope, and breadth of over 100 research projects in forest tree nutrition being conducted by state and federal agencies, industries, and educational institutions, conclude the symposium. These papers in part stress the administrative outlook on values and purposes of different types of nutrition research.

The bulletin is not in any sense a manual telling how and when to fertilize forest trees. As the foreword points out, ". . . information on mineral element requirements and growth responses of southern forest species is rather meager." To expand this information, many of the approaches and techniques suggested by the authors will have to be used. For this reason the material in this bulletin will be of current value mainly to those who are interested in research on forest tree nutrition.

EDWARD I. SUCOFF
Northeastern Forest Experiment Station, Forest Service, U. S. Department of Agriculture, Laurel Research Center, Laurel, Md.

The Grasses: Earth's Green Wealth

By Alma Chestnut Moore. 150 pp. Illus. The Macmillian Company, New York. 1960. $5.

Written in an interesting, lucid style, this informative little book brings together a large amount of information without becoming tedious. It could well serve as a model for those attempting to present scientific material to the nonspecialist.

After three introductory chapters discussing origins, botanical information about grasses, and the role of grasses as land builders, Mrs. Moore emphasizes the cereal grasses. One chapter covers each of the five major grains: wheat, barley, corn, rice, and oats; another is devoted to rye, sorghum and millet. Origins, methods of cultivation, morphology, and uses are discussed with authority. Many points of information and understanding not found in most texts on economic botany are included. A chapter on sugar cane is particularly well done, emphasizing the history of sugar and the processes involved in its refinement. Other chapters deal with insects and diseases and the importance of grasses in world economy.

The final chapter, "Grasses to the Rescue," presents the role of grasses in soil conservation, giving a very graphic picture of the dust bowl formation. "The grasses, so unassuming yet so important, can accomplish miracles if we let them work. Should they fail for a single season, famine would put an end to the earth. For science has proved what wise Isaiah knew instinctively some 27 centuries ago: 'All flesh is grass and the goodliness thereof is as the flower of the field'."

The author, daughter of botanist Vitor King Chestnut, will be recognized as a contributor to *American Forests, Nature Magazine,* and *Scientific American,* as well as being the author of several other

books, including *The Friendly Forest*. She has written the book with accuracy as well as style, and she has carefully checked the facts with authorities.

The Grasses: Earth's Green Wealth is enjoyable and informative reading and could be recommended to anyone interested in bettering his understanding of the earth's vegetation. It should certainly be in the economic botany section of every college library.

ISABEL AHLGREN
Duluth, Minn.

❦❦❦

Thousand Acre Marsh

By Dudley Cammett Lunt. 174 pp. Illus. The Macmillan Company, New York. 1959. $3.75.

Subtitled *A Span of Remembrance*, the experiences gathered in a lifetime of observing nature are, as the author says, "about the only thing a man could acquire that someone else did not have a stake in." Their locales are two fascinating places—the coasts and woods of the State of Maine and the gentle hill country and coastal plain of Delaware.

The discerning reader will promptly realize that Mr. Lunt writes with the sensitivity and richness of Thoreau. And this is not surprising since Mr. Lunt is the editor and arranger of Thoreau's *The Maine Woods* and *The Concord and the Merrimack*, two books which will immediately recommend this one to all those who delight in acute observation and vivid description of the outdoor world.

Any one assuming that such praise is extravagant will learn differently on reading his description of falling snow and the screaming of gulls and "a full moon trail down the western sky in the pale light of the false dawn." Here are the authentic odors of the salt marsh and of the dark woods after a rain. Here is much captured beauty in a small package.

Some of America's most delightful nature writers have not been scientifically educated biologists. Mr. Lunt, a lawyer by profession, is in that tradition. But if this pleasant book suffers on that account, this reviewer has been unable to detect it.

Start, then, with him in the spring of the year and follow him through the four seasons, and you will have a rewarding experience.

HENRY CLEPPER

❦❦❦

United States Department of the Interior Forest Conservation

By John F. Shanklin and Bureau Chiefs. Conservation Bulletin 42. 86 pp. Illus. U. S. Department of the Interior, Washington, D. C. 1960. 40¢.

It is not only the general public but foresters as a group who fail to understand the far-flung forestry activities of the Department of the Interior. Simply being their custodian, to say nothing of managing 186 million acres of forest lands, is a large and difficult task. Four bureaus are involved, each limited in its particular policies by different laws. They protect; foster the growth and usually the selling of timber; reconcile this with grazing and recreational use, and sustained yield; and produce a surprising amount of revenue. Under the somewhat awkward title *United States Department of the Interior Forest Conservation*, all of this activity is clearly explained.

Particularly interesting are the paragraphs concerning policies and procedure on Indian lands and on the revested California-Oregon Railroad and Coos Bay Wagon Road grant lands. The former have many problems of ownership, accounting, working individual allotments into over-all sustained yield and income plans, and playing the role of guardian of the Indians and their interests. The management of Indian lands falls to the Department's Bureau of Indian Affairs. A section on the three commercial Indian sawmills which it has been the policy of the federal government to operate on Indian lands, tells the long story of the adventures on the Menominee, Red Lake, and Navajo reservations which have recently been in the news in connection with plans for terminating federal supervision over Indian affairs.

The Oregon and California and the Coos Bay Wagon Road grant lands present a checkerboard pattern, some of which is managed by the Bureau of Land Management, while that within the national forests is the responsibility of the Forest Service in the Department of Agriculture. The recounting of the history of this "valuable piece of real estate," which bounced back into the ownership of the United States, is long and of particular interest since the timber is now under excellent management.

Besides the O and C lands there is an estimated stand of 450 billion board feet of timber on the public domain scattered over 25 states, including Alaska, which engages the attention of the Bureau of Land Management and its Forestry Office.

Two other Department of the Interior bureaus are engaged in managing and protecting timber resources: the National Park Service where protection predominates, and the Bureau of Sport Fisheries and Wildlife, which practices forest management on a total of about 800,000 acres of commercial forest included in the refuge system.

The forest policy of each of these Department of the Interior bureaus is briefed in this interesting bulletin. There are 18 excellent halftones, one map, and a diagrammatic representation of a forest managed on a sustained-yield basis under a clearcutting system.

SHIRLEY W. ALLEN
Visiting professor, Tom Wallace Chair of Conservation, University of Louisville, Ky.

Current Literature

Compiled by LOIS MCALLISTER, *Assistant Librarian, State University College of Forestry at Syracuse University*
Range Management Section Compiled by NELLIE G. LARSON, *Library, U. S. Department of Agriculture*

General

Directory of Organization and Field Activities of the Department of Agriculture, 1960. 363 pp. U. S. Dept. of Agric., Washington 25, D. C. Agric. Handbook No. 76. $1. (Govt. Print. Off.)

Redwood. By H. S. Betts. 6 pp. U. S. Forest Service, Washington 25, D. C. Rev. 1959. (American Woods.) 5 cents (Govt. Print. Off.)

Specifications for Calculating Several Equations of Relationship Between Two Variables on a Type 650 Electronic Computer. By D. R. Gedney, D. E. Martin, and F. A. Johnson. 15 pp., p. 8a. Tables. Pacific Northwest Forest and Range Expt. Sta., Portland, Ore. 1959, 1960.

Tree Bracing. 21 pp. Illus. U. S. National Park Serv., Wash. 25, D. C. Rev. 1959. Tree Press. Bul. No. 3. 15 cents (Govt. Print. Off.)

Forest Economics

Farm Woodlands and the Timber Economy of Michigan. By L. M. James. pp. 563-83. Tables. 1960. Reprint from Quarterly Bulletin of Michigan Agric. Expt. Sta., East Lansing, v. 42, no. 3.

Forest Management

Forest Densities, Ground Cover and Slopes in the Snow Zone of the Sierra Nevada West-Side. By L. G. Richards. 21 pp. Illus. Pacific Southwest Forest and Range Expt. Sta., Berkeley, Calif. 1959. Tech. Paper No. 40.

Three Scales of Aerial Photography Compared for Making Stand Measurements. By E. J. Rogers, G. Avery, and R. A. Chapman. 4 pp. Tables. Northeastern Forest Expt. Sta., Upper Darby, Pa. 1959. For. Res. Note No. 88.

Volume Tables for Aerial Timber Estimating in Northern Minnesota. By G. Avery and M. P. Meyer. 21 pp. Illus. Lake States Forest Expt. Sta., St. Paul 1, Minn. 1959. Sta. Paper No. 78.

Forest Products

Charcoal from Chemi-Peeled Hardwoods. By R. H. Fenton. 4 pp. Illus. Northeastern For. Expt. Sta., Upper Darby, Pa. 1959. For. Res. Note No. 94.

Foreign-Language Translation of Forest Products Research Results. 25 pp. U. S. For. Products Lab., Madison 5, Wis. 1959.

Logging and Milling

Improvements Through Research on Thin Circular Saw Blades. By C. P. Berolzheimer and C. H. Best. 11 pp. Illus. Forest Products Research Soc., Madison 5, Wis. Reprint from Forest Products Journal, v. 9, no. 11, Nov., 1959.

The Production and Marketing of Pine Wood Residues by Small Sawmills. By Milton Applefield. 14 pp. Tables. Texas Forest Serv., Lufkin. 1960. Bul. No. 50.

Pathology

Brown-Spot Needle Blight of Longleaf Pine. By P. C. Lightle. 7 pp. Illus. U. S. Forest Service, Washington 25, D. C. 1960. Forest Pest Leaflet No. 44. 5 cents (Govt. Print. Off.)

Butt Rot of Southern Hardwoods. By E. R. Toole. 4 pp. Illus. U. S. Forest Service, Washington 25, D. C. 1960. Forest Pest Leaflet No. 43. 5 cents (Govt. Print. Off.)

Losses from Defect in Piedmont Hardwoods. By W. C. Bryan. 31 pp. Illus. Southeastern Forest Expt. Sta., Asheville, N. C. 1960. Sta. Paper No. 109.

Protection

A Special Fire Plan for the Santee Experimental Forest. By Thomas Lotti. 26 pp. Illus. Southeastern Forest Expt. Sta., Asheville, N. C. 1960.

Swelling Bentonite Clay, A New Forest Fire Retardant. By C. B. Phillips and H. R. Miller. 30 pp. Illus. Pacific Southwest Forest and Range Expt. Sta., Berkeley, Calif. 1959. Tech. Paper No. 37.

Range Management

Grasses in Agriculture. By R. O. Whyte, T. R. G. Moir, and J. P. Cooper. 417 pp. Food and Agriculture Organization of the United Nations, Rome. 1959. FAO Agric. Studies No. 42. $4. (Columbia Univ. Press, sales agent.)

Notes on Western Range Forbs: Equisetaceae through Fumariaceae. By W. A. Dayton. 254 pp. Illus. U. S. Forest Service, Washington 25, D. C. February 1960. Agric. Handbook No. 161. $1.75. (Govt. Print. Off.)

Research at the San Joaquin Experimental Range. By J. N. Reppert and E. J. Woolfolk. 11 pp. Illus. U. S. Forest Service, Pacific Southwest Forest and Range Expt. Sta., Berkeley, Calif. March 1960.

Recreation

Recreation Today and Tomorrow in the Missouri River Basin. 135 pp. Illus. U. S. National Park Serv. (Missouri Basin Inter-Agency Committee cooperating). Washington 25, D. C. 1959. $3. (Govt. Print. Off.)

A Report on Recreation to the Governor and to the Citizens of Oregon. 29 pp. Governor's State Committee on Children and Youth, Recreation Study Committee, Salem, Ore. 1959.

Silviculture

A Cooperative Experimental Planting Project in Ontario. By W. M. Stiell. 6 pp. Illus. Canada Dept. of Northern Affairs and National Resources, Forestry Branch, Forest Research Div., Ottawa. 1960.

Manual of Vegetation Analysis. By S. A. Cain and G. M. deO. Castro. 325 pp. Illus. Harper & Brothers, 49 E. 33d St., New York, N. Y. 1959. $7.50.

Softwood Distribution Maps for the South. By P. L. Janssen and M. R. Weiland. 12 pp. Illus. Southern Forest Expt. Sta., New Orleans, La. (and Southeastern Forest Expt. Sta., Asheville, N. C.) 1960. Forest Survey Release No. 83.

Some Estimates of Growth and Mortality from the Malheur National Forest in Eastern Oregon. By D. R. Gedney and V. E. Hicks. 7 pp. Pacific Northwest Forest and Range Expt. Sta., Portland, Ore. 1959. Res. Note No. 166.

Trees in Kensington Gardens; Fourth Report of the Ministry of Works' Advisory Committee on Forestry. 12 pp. Plates. H. M. Stationery Off., London. 1959. 1s. 6d.

Wood Technology and Utilization

Atlas des Bois dela Côte d'Ivoire. Tome 3. By Didier Normand. 182 pp. Plates. Centre Technique Forestier Tropical, Nogent-sur-Marne, France. 1960.

Effect of Wood Moisture Content on Gluing. By E. G. Bergin. 13 pp. Tables. Canada Dept. of Northern Affairs and National Resources, Forestry Branch, Ottawa. 1959. Forest Prod. Lab. Tech. Note No. 12.

Identification of Coniferous Woods. By B. F. Kukachka. U. S. Forest Products Lab., Madison 5, Wis. 1959. TGUR-21.

Nailing Better Wood Boxes and Crates. By L. O. Anderson. 40 pp. Illus. U. S. Dept. of Agric., Washington 25, D. C. 1959. Agric. Handbook No. 160. 20 cents (Govt. Print. Off.)

Tension Wood and Its Relation to Splitting in Hickory. By N. B. Goebel, M. A. Taras, and W. R. Smith. 21 pp. Illus. South Carolina Agric. Expt. Sta., Clemson (Southeastern Forest Expt. Sta., Asheville, N. C., cooperating). 1960. Bul. No. 480.

Society Affairs

Officers and Council
1960-1961

CHARLES A. CONNAUGHTON, *President*
U. S. Forest Service
630 Sansome Street
San Francisco 11, Calif.

B. E. ALLEN
Union Bag-Camp Paper Corp.
P. O. Box 570
Savannah, Ga.

WILLIAM C. BRAMBLE
Department of Forestry and Conservation
Purdue University
Lafayette, Ind.

DONALD E. CLARK
U. S. Forest Service
Federal Center, Building 85
Denver 7, Colo.

HENRY J. MALSBERGER, *Vice President*
Southern Pulpwood Conservation Association
900 Peachtree Street, N.E.
Atlanta 9, Ga.

KENNETH P. DAVIS
School of Natural Resources
University of Michigan
Ann Arbor, Mich.

GEORGE A. GARRATT
School of Forestry
Yale University
New Haven 11, Conn.

WILLIAM D. HAGENSTEIN
Industrial Forestry Association
1410 S.W. Morrison Street
Portland 5, Ore.

HENRY CLEPPER, *Executive Secretary*
Mills Building, 17th Street at Pennsylvania Avenue, N.W.
Washington 6, D. C.

SVEND O. HEIBERG
College of Forestry
State University of New York
Syracuse 10, N. Y.

RICHARD J. PRESTON, JR.
School of Forestry
North Carolina State College
Raleigh, N. C.

CHARLES L. TEBBE
U. S. Forest Service
Federal Building
Missoula, Mont.

Sixtieth Annual Meeting
Society of American Foresters
Washingon, D. C., November 13-16, 1960

The nation's professional foresters will celebrate the sixtieth anniversary of the founding of the Society of American Foresters, November 13-16, at the annual national meeting in Washington, D. C.

All sessions will be held in the Sheraton Park Hotel, beginning with a meeting of the Council and Section delegates on Sunday, November 13, and concluding with the annual dinner and dance Wednesday evening, November 16.

"Forestry's Expanding Horizons" is the 1960 theme. Around this subject, speakers will present technical papers in all phases of forestry.

There are no scheduled field trips planned in connection with the 1960 annual meeting.

Opening General Session

President Charles A. Connaughton will formally open the first general session on Monday morning, November 14. Vice President Henry J. Malsberger will then serve as chairman of the session.

Three keynote speakers will speak to the theme.

Richard A. McArdle, chief of the U.S. Forest Service, will review the past sixty years of forestry in the United States and will predict challenges and conditions to be faced by the foresters of the future.

William M. Bailey of International Paper Company's Southern Kraft Division will discuss highlights during the period 1900-1960 of achievements in industrial forestry as well as the expected future technical accomplishments.

William C. Bramble, head of the Department of Forestry and Conservation at Purdue University, will cover sixty years of forestry from the sociological aspects, taking into consideration future uses of forests, and needs in education and research.

Society Affairs Session

On Monday afternoon, November 14, the customary Society Affairs session will include reports by the president, the executive secretary, the editor, and the several committees.

This portion of the program is especially designed to inform members about the operations of the Society. Time will be allowed for open forum discussion from the floor of any mat-

ters having to do with Society administration and business.

There will then follow a special session devoted to forestry education, keynoted by S. T. Dana and to be followed by a discussion and question period.

This session will conclude the scheduled events on Monday. There will be no official meetings either on Monday or Tuesday evenings, which will be left open for alumni meetings and other social functions.

Division Meetings

Tuesday and Wednesday will be devoted to the meetings of the nine subject Divisions. It is expected that at least 60 papers on all aspects of forestry will be presented at these sessions.

There will be all-day meetings of the Division of Silviculture and the Division of Forest Management.

Half-day meetings will be scheduled by the Divisions of Economics and Policy, Education, Forest Products, Forest Recreation, Forest-Wildlife Management, Range Management, and Watershed Management.

All Division meetings have been scheduled during the daytime hours.

Ladies' Program

According to Ladies' Committee Chairman, Mrs. George M. Jemison, an interesting and varied program is being arranged. While a number of famous sites in the District of Columbia and adjacent Virginia will be visited, Mrs. Jemison points out that there will be ample opportunity for free time during the meeting. One of the highlights of the ladies' program will be a tour of several embassies. The foresters' wives will also be guests for afternoon tea at the embassy of the Federal Republic of Germany.

The Annual Dinner

The Society's sixtieth annual dinner will be served in the Sheraton Park Hotel. Tom Gill, Fellow of the Society and Schlich medallist, will serve as toastmaster.

President Connaughton will present the Sir William Schlich Memorial Medal, the Gifford Pinchot Medal, and the award for achievement in biological research. In keeping with custom, the names of the recipients will not be divulged until the evening of the dinner.

A guest speaker of national reputation will give the afterdinner address which will be followed by a choral group.

ARTHUR W. GREELEY. General Chairman for the Meeting.

After an intermission, there will be dancing from 10 p.m. to 1 a.m. in the ball room. This will conclude the meeting.

Meeting Committees

General chairman for the meeting is Arthur W. Greeley, U.S. Forest Service, Washington, D. C. John F. Shanklin, Department of the Interior, and H. R. Josephson, Forest Service, both also of Washington, D. C., are program and local arrangements chairmen, respectively.

Other members of the Committee on Arrangements are Tom Gill, Charles Lathrop Pack Forestry Foundation, *60th Annual Dinner;* Robert E. Reinhardt, Forest Service, *Welcoming;* Robert B. Moore, National Park Service, *Meeting and Conference Rooms;* Ralph D. Hodges, Jr., National Lumber Manufacturers Association, *Exhibits;* Walter L. Graves, Forest Service, *Projection and Amplifying Equipment;* Mrs. George M. Jemison, *Women's Activities;* and James C. McClellan, American Forest Products Industries, *Publicity.*

Chairman Arthur W. Greeley stated, "Society members working on the committees for the November meeting are planning this 60th anniversary right down to the last detail. Washington, D. C., is the birthplace of the Society, and we are following the established custom by returning to the nation's capital every tenth year for our national meeting. Foresters' wives especially will find this an interesting area to visit. We are looking for an outstanding turnout of foresters from all over the United States and from Canada. We extend a sincere invitation to every member and Section and Chapter officer and his wife to attend."

Hotel Reservations

The August issue of the JOURNAL will include a list of cooperating hotels, together with their addresses and rates.

All Society meetings and events will be held in the Sheraton Park Hotel, whose address is Connecticut Avenue at Woodley Road, N.W., Washington 8, D. C. This hotel has 800 rooms.

Consult the August issue for the posted rates that will be in effect for the period of the meeting.

Schedule of Events

Sunday, November 13

SAF Council meeting: morning.

Joint meeting of the Council and Section delegates: afternoon.

Editorial Board, JOURNAL OF FORESTRY: afternoon.

Association of Consulting Foresters: evening.

Monday, November 14

General Session: morning.

Society Affairs Session: afternoon.

Alumni functions (no scheduled SAF meetings): evening.

Motion pictures: evening.

Tuesday, November 15

Division of Silviculture: morning and afternoon.

Division of Forest Products: morning.

Division of Economics and Policy: afternoon.

Division of Forest Recreation: morning.

Division of Forest-Wildlife Management: afternoon.

Alumni functions (no scheduled SAF meetings): evening.

Wednesday, November 16

Division of Forest Management: morning and afternoon.

Division of Education: morning.

Division of Range Management: morning.

SAF Council meeting: afternoon.

Division of Watershed Management: afternoon.

SAF dinner and dance: evening.

Report of Council Meeting

May 9-10, 1960, Grand Isle, La.

MEMBERS of the Council, Society of American Foresters, meeting at Grand Isle, La., May 9-10. Seated *left* to *right*: Donald E. Clark; Vice President Henry J. Malsberger; President Charles A. Connaughton; George A. Garratt; B. E. Allen. Standing: Kenneth P. Davis; Executive Secretary Henry Clepper; William D. Hagenstein; Svend O. Heiberg; Richard J. Preston, Jr.; William C. Bramble. Not shown: Charles L. Tebbe, absent due to illness.

A meeting of the Council of the Society of American Foresters was held May 9 and 10 at Grand Isle, La., where the members were guests of the T. L. James & Company, Inc. of Ruston, La.

Ten Council members (a quorum) were present, as follows: President C. A. Connaughton, Vice President H. J. Malsberger, B. E. Allen, W. C. Bramble, D. E. Clark, K. P. Davis, G. A. Garratt, W. D. Hagenstein, S. O. Heiberg, and R. J. Preston, Jr., together with Henry Clepper, executive secretary. Charles L. Tebbe was unavoidably absent because of illness.

1960 Annual Meeting

A report on plans for the 1960 annual meeting to be held in Washington, D. C. on November 13-16, was made by Mr. Clepper in behalf of Chairman Arthur W. Greeley of the Committee for the Meeting.

In the budget for the current fiscal year is an item of $1,000 to pay for printing the *Proceedings* of the 1959 annual meeting. Inasmuch as this amount will not be needed for that purpose, on motion by Mr. Hagenstein, seconded by Mr. Clark, the Council voted to earmark the $1,000 for 1960 annual meeting expense.

Additionally, in view of the historical and professional significance of the sixtieth anniversary meeting, the Council, on motion by Mr. Clark, seconded by Mr. Garratt, voted to authorize the expenditure of an amount not to exceed $1,000 if actually needed to help finance the meeting.

Another joint conference of the Council and Section delegates will be held at 2 p.m., Sunday, November 13, in the Sheraton Park Hotel. At this conference, a major subject for discussion will be Society policy formulation and action. This topic was selected by vote of the Council on a motion made by Mr. Garratt, seconded by Mr. Hagenstein. There will also be a report from the Committee to Improve Society Communications (Donald E. Clark, chairman), authorized by the Council at the meeting of November 1959.

Thus, in accordance with the Council's wishes, the following order of meetings and conferences will be in effect.

Sunday morning, November 13. Executive meeting of the Council.

Sunday afternoon, November 13. Joint meeting of Council and Section delegates.

Monday afternoon, November 14. Society Affairs session. In addition to the officers' and committee reports, there will be a special program devoted to forestry education.

Wednesday afternoon, November 16. Second executive meeting of the Council.

1961 Annual Meeting

The 1961 annual meeting is scheduled to be held jointly with the Canadian Institute of Forestry, in Minneapolis, October 8-12.

Frank H. Kaufert of the University of Minnesota, Saint Paul, has been designated by the Council to serve as general chairman for the meeting. Serving with him as CIF co-chairman will be George R. Sonley, chief forester for the Marathon Corporation of Canada Limited, of Port Arthur, Ontario.

On motion by Dr. Preston, seconded by Mr. Hagenstein, the Council voted to invite M. B. Dickerman, director of the Lake States Forest Experiment Station, to serve as chairman of the Committee on Arrangements. A co-chairman from Canada will be designated later by the CIF.

In view of the fact that the Canadian Institute of Forestry does not have subject Divisions, as does the SAF, the 1961 joint meeting will not be organized on the basis of Division meetings as is customary with the

SAF. Instead, it is expected that the CIF and the SAF will jointly arrange technical sessions on the subjects customarily considered in SAF Division meetings and in CIF committees.

Division Meetings

The Council reviewed the decisions of past Councils with respect to the length of time alloted to individual subject Division meetings, and reaffirmed the policy as follows:

The Divisions of Education, Forest Management, and Silviculture may each continue to schedule full-day meetings; that is, each may arrange a morning and an afternoon meeting.

The Divisions of Economics and Policy, Forest Products, Forest Recreation, Forest-Wildlife Management Range Management, and Watershed Management will each continue to be authorized to arrange half-day meetings, with the understanding that two Divisions may jointly arrange a full-day program.

Further review of the operations of the Divisions and of the distribution of time alloted to them will be undertaken by a Council committee consisting of Mr. Hagenstein and Mr. Clark.

Biennial Election of 1959

The Council reviewed the results of the regular biennial election of 1959 and the procedure under the system of proportional representation that has been in use for the election of Society Councils. No change was proposed in the standard procedure for holding elections under this system, as recommended by the Proportional Representation League.

Also reviewed were the results of the election of Fellows. Bylaw 11 provides that the total number of votes necessary to elect a Member nominated to the grade of Fellow shall be not less than 50 percent of the total number of votes cast. Of 31 Members nominated for Fellow in the election of December 1959, 13 were elected. No change was proposed in the procedure for holding these elections.

At the Council meeting in November 1960, consideration will be given to the prepayment of postage on ballot envelopes as a possible means of obtaining a larger return of ballots.

Botanical Nomenclature

At the International Botanical Congress held in Montreal in August 1959, it was voted in the section on plant nomenclature to undertake a study and report upon the correct scientific name, with a view toward stabilization of the name, for any plant widely used in agriculture, forestry, or horticulture submitted by interested persons in these fields. Financial assistance is needed to employ a botanist to undertake the literature search in all major languages to provide the data for action toward name stabilization.

Under the procedure set up, names of economically important plants are being submitted to the General Committee on Botanical Nomenclature at the International Bureau for Plant Taxonomy and Nomenclature in Utrecht, The Netherlands. Reed C. Rollins, professor of systematic botany at Harvard University, is a member of the General Committee, which has requested the Society of American Foresters to contribute financially to this enterprise.

Recognizing that such a goal is a worthy one as regards the scientific literature of forestry, the Council of the Society, on a motion by Prof. Heiberg, seconded by Mr. Malsberger, voted to contribute $100 toward the project.

In further reference to this subject, the attention of members of the Society is invited to the article "Nomenclature at the Montreal International Botanical Congress" by Elbert L. Little, Jr., in the JOURNAL OF FORESTRY for May 1960, pages 394-395.

Natural Forest Areas

Since 1947 the Society of American Foresters, through its Committee on Natural Areas, has been conducting a survey to locate natural forest areas with a view toward their preservation for ecological and other scientific research. Currently, an intensive survey in the southeastern states is in progress, financed by a grant of $7,000 from Resources for the Future, Inc.

Preliminary findings indicate that a substantial number of the areas in the eastern states will be on privately owned lands. It is the Society's intention to try to assure the preservation of such natural areas through acquisition by some appropriate agency, public or private.

The Nature Conservancy of Washington, D. C., is a national organization likewise working for the preservation of natural areas for their scientific and esthetic values. In April 1960, the Conservancy, acting through its secretary, Elting Arnold, proposed that the Society and his organization enter into a joint effort to preserve privately owned natural forest areas. In accordance with the proposal the Society and the Conservancy would jointly attempt to raise funds to finance the purchase of such lands.

After review of the work of the Society's Committee on Natural Areas and of the activities of the cooperating Sections, the Council, on motion by Dr. Preston, seconded by Mr. Hagenstein, voted as follows: the Society appreciates the offer of cooperation by the Nature Conservancy; and the Society will continue its strong interest and support of the program to preserve natural forest areas. However, the Council believes that the interests of both the Conservancy and the Society can best be furthered by continuing to work closely together on an informal basis, but without entering into a formal agreement.

National Watershed Congress

The National Watershed Congress, whose seventh annual meeting was held in Washington, D. C. in April 1960, is supported by 25 industrial, agricultural, and conservation organizations. Its purpose is to improve natural resources management on a watershed basis. The Congress is not an action body; it is rather a forum for the discussion of ways to expedite local watershed management programs.

An invitation was extended to the Society of American Foresters by the Steering Committee of the Congress to become a participating organization. On a motion by Mr. Allen, seconded by Mr. Clark, the Council voted to accept the invitation. As a participating organization the Society will contribute $100 annually to help meet Congress expenses.

International Union for Conservation of Nature and Natural Resources

An invitation has been extended to the Society of American Foresters to join the International Union for Conservation of Nature and Natural Resources, Brussels, Belgium. The annual dues are $50.

On a motion by Mr. Hagenstein, seconded by Mr. Clark, the Council voted to defer action pending receipt of more information about the Union and its activities.

Awards in 1960

By vote of the Council the following awards will be presented at the sixtieth anniversary dinner of the Society in Washington, D. C., on the evening of November 16, 1960:

The Sir William Schlich Memorial Medal.

The Gifford Pinchot Medal.

The Award for Achievement in Biological Research.

The presentations will be made by President Connaughton. In accordance with established custom, the names of the recipients will not be revealed until the time of presentation.

On a motion by Dr. Preston, seconded by Mr. Clark, the Council voted to make awards to living persons only; that is, persons who are living at the time the selections are made.

Visiting Scientists Program

The National Science Foundation, Washington, D. C., administers several programs for education in the sciences. One of these is the Visiting Scientists Program, described by NSF as follows:

"This program facilitates visits by distinguished scientists to colleges and small universities for periods of several days to give lectures, to conduct classes and seminars if desired, and to meet students, faculty members, and administrative officers on an informal as well as formal basis in order to stimulate interest in science. The program is administered through grants to the appropriate professional scientific societies."

The National Science Foundation has made a grant of $15,730 to the Society of American Foresters for the purpose of conducting a Visiting Scientists Program in Forestry for a period of one year, beginning July 1, 1960.

As outlined by NSF, the objectives of the program are:

1. To strengthen undergraduate and graduate forestry work in colleges.
2. To provide staff and students with opportunity for additional contacts with productive and creative scientists.
3. To aid in the motivation of able college students toward careers in forestry and teaching in the field of forestry.

On a motion by Mr. Garratt, seconded by Mr. Hagenstein, the Council voted to authorize a small committee to administer the program. Subsequently, President Connaughton named Mr. Garratt as chairman and adviser, and Mr. Clepper as director.

Any institution of higher learning that offers curriculums or courses in forestry will be eligible to participate in the program. No costs or expenses are involved since the NSF grant will reimburse the visiting scientists for travel expenses together with an honorarium while on-campus visits. Additional information about the program will be provided later to all the institutions having forestry courses.

Fifth World Forestry Congress

A special fund is being set up under the chairmanship of Tom Gill to contribute toward helping defray the expenses of foreign foresters who are outstanding specialists in some phase of applied forestry or research, whose presence at the Fifth World Forestry Congress to be held in Seattle in August 1960 would add to the technical sessions. Some of these persons, although key figures in their native countries, will need financial assistance in order to come to the United States to present invited papers.

On a motion by Mr. Allen, seconded by Mr. Malsberger, the Council on November 15, 1959 voted to make a token contribution of $100 toward this fund.

In view of the importance of the participation in the Congress by eminent foreign foresters who may need travel assistance, the Council, on a motion by Mr. Hagenstein, seconded by Mr. Garratt, voted to increase the contribution to $500, including the $100 already earmarked.

This World Forestry Congress will provide an unusual opportunity for the two national forestry organizations —The American Forestry Association and the Society of American Foresters —to greet foreign delegates in behalf of the public interests and the professional interests in forestry. Accordingly, under authorization by the Board of Directors of the Association and by the Council of the Society, a reception for heads of delegations and American Congress officials will be held on August 30 in Seattle. On a motion by Mr. Clark, the Council voted to contribute $500 as the Society's share of this project.

Natural Resources Council

Since 1947 the Society of American Foresters has been a member of the Natural Resources Council of America. Currently, 37 national and regional organizations interested in natural resources hold membership in NRC. As a "scientific society member" the SAF pays dues of $50 annually.

On a motion by Mr. Hagenstein, seconded by Mr. Garratt, the Council voted to authorize the President to appoint a Council committee to review the question of the Society's continued affiliation with the Natural Resources Council.

Subsequently, President Connaughton named Dr. Bramble and Mr. Gar-

It's Coming — August 1

Yes, that's the date—August 1—when Forestry Suppliers' new Catalog No. 9 will be off the press, ready for mailing. And what a treat is in store for you—a new world of forestry supplies and equipment spread out in 184 exciting pages! Here's what to look for:

- The most comprehensive coverage of forestry tools and equipment ever assembled—all items of guaranteed performance.
- More than 900 illustrations — and clear, easy-to-read type.
- Prices, along with code numbers to order by, are listed conveniently with each item. No supplemental price list to bother with.
- Greatly expanded time-saving index —for your convenience.

You'll find in Catalog No. 9 a show window of the tools of the times—new and improved items from all over the world. And the great bulk of the more than 2,500 listings will be in stock, on our shelves—your guarantee of the fast "what-you-need-when-you-need-it" service for which Forestry Suppliers, Inc. is noted. So mark the date—August 1—on your supply calendar!

IMPORTANT: If you are an active customer of Forestry Suppliers a copy of Catalog No. 9 will be mailed you August 1 — if not, write for a copy —and do it today.

Forestry Suppliers, Inc.

P. O. Box 8305, Battlefield Station
Jackson 4, Mississippi

ratt to the committee with a request that they report to the Council at its November 1960 meeting.

Policy on Wilderness

At the Council meeting held March 17 and 18, 1958, the following policy on wilderness preservation was unanimously adopted:

"The Council of the Society of American Foresters reaffirms its support of the concept of multiple use of forest and other wild lands, as approved by referendum of the membership in 1947. The Council believes that wilderness is a proper part of a program of multiple use for public lands. Furthermore, the Council believes that the determination of areas suitable for wilderness and the boundaries thereof are responsibilities and functions of the personnel charged with administration of these lands."

On a motion by Dr. Preston, seconded by Dr. Davis, the Council voted (Mr. Clark abstaining) to reaffirm the previous policy, recognizing that adjustments may be indicated pending the report of the National Outdoor Recreation Resources Review Commission and further study by the Council.

Forest Products Week

National Forest Products Week, October 16-22, 1960, has been proposed in support of the national wood promotion program by the lumbermen's fraternity, Hoo-Hoo International. Jack S. Berry of Sacramento, Calif. is chairman of the national committee.

On a motion by Mr. Clark, seconded by Mr. Hagenstein, the Council endorses National Forest Products Week, October 16-22, 1960, and recommends strong Section and Chapter support and participation in their localities to the end of emphasizing the important place of the forestry profession in managing land for a permanent supply of forest products for the use and benefit of the American people.

News items about the wood promotion program will continue to appear in the JOURNAL OF FORESTRY.

Planning Committee to Study Ten-Year Program for SAF

The decade 1961-1970 promises to be a momentous period in the history of the Society and the development of the profession of forestry. In order that the Society may continue to function in the best interests of the profession and to provide leadership in those phases of its growth where its leadership is appropriate and necessary, the executive secretary proposed that the Council might wish to set up a special Planning Committee to study what the Society's principal goals should be during the coming decade and to suggest ways and means by which the goals might be attained.

On a motion by Mr. Hagenstein, seconded by Mr. Allen, the Council authorized the president to appoint a special Planning Committee. The personnel will be announced later.

Endowment Fund

At the Council meeting held March 17 and 18, 1958 the members voted to investigate, through a committee, the possibility of setting up a permanent endowment fund for the Society. (See the JOURNAL OF FORESTRY for May 1958, page 364.)

The committee subsequently appointed consisted of D. E. Clark, M. K. Goddard, and then President G. A. Garratt. A working committee to undertake the project was authorized at the Council meeting of September 28, 1958. Mr. Garratt accepted the chairmanship.

At the Council meeting of May 8, 1960 Mr. Garratt reported that he hopes to activate a committee in the near future to start raising funds.

Information for Newly Elected Council Members

The following resolution was offered by Mr. Allen, seconded by Mr. Hagenstein, and adopted:

"Whereas, each two years there is an election of the SAF electorate whereby officers of the Society are chosen, including members of the Council;

"And Whereas, there are always newly elected officers, including Council members who have not theretofore served in such a capacity;

"And Whereas, it is desired and beneficial that novitiate officers and Council members should be posted on current affairs; and they themselves seek same;

"Now therefore be it resolved, that when such instances occur, the executive secretary will prepare a letter to each newly elected member calling specific attention to those issues of the JOURNAL OF FORESTRY (including issues to be printed) where minutes of the past two meetings of the Council can be found. In addition, said letter should also include financial statements including past, current, and proposed budgets where applicable. This letter preferably should reach each concerned officer or Council member not later than 90 days prior to the next Spring Council meeting."

Division of Range Management

Following the meeting of the Division of Range Management held November 18, 1959 in San Francisco, the members by mail ballot elected as chairman a person who is unable to serve.

Accordingly, the Council requests that the elected vice chairman, Lowell K. Halls serve as chairman; and the elected secretary, Charles Terwilliger, Jr., serve as vice chairman; and further that they together designate a secretary to serve *pro tem* at the Washington D. C. meeting in November 1960.

FREE CATALOG for the PROFESSIONAL FORESTER

A new dimension in forestry service . . .

48 PAGES FULLY ILLUSTRATED

Write today, for your free copy of Catalog No. 6. We ship within 24 hours of receipt of order—your money cheerfully refunded if not satisfied.

NASCO Fort Atkinson, Wisconsin
"Supplies and Equipment for the Professional"

Profits GROW with MORA TREEFEED

Greater Growth—Bigger Profits!
MORA TREEFEED
TREEFEED-treated firs grew 50.8 in. in 3 years; control firs, only 36.4 in. Find out how YOU can get better money crops faster! Write today for TREEFEED data.

MORA CHEMICAL CORPORATION
2450 6th Avenue So.
Seattle 4, Wash.

Proposed Subject Division of Forest Fire

At the meeting of the Council held November 15 and 18, 1959 in San Francisco a petition was presented requesting the Council to authorize a new Division of Forest Fire Science. (See the JOURNAL OF FORESTRY for February 1960, page 131.)

The Council instructed the President to appoint a temporary Committee on Forest Fire Science to consider the proposal. Subsequently named to the committee were Kenneth P. Davis, chairman, and Jack S. Barrows, Edward M. Gaines, and Kenneth J. Seigworth. This committee has been requested to report to the Council at its meeting in November 1960.

Meanwhile, the committee is conducting an opinion poll of a sampling of SAF members by questionnaire. Dr. Davis in a preliminary report indicated there is some sentiment to call it the Division of Forest Fire, provided it is deemed necessary and is authorized by the Council.

Unprofessional Conduct

The Society has a standing Committee on Professional Ethics of which the vice president has traditionally served as chairman. At various times proposals have been made to review and recodify the procedures set up in the Bylaws for handling cases arising out of charges of unprofessional conduct.

Following discussion by Chairman Malsberger and Dr. Davis of the present unsatisfactory procedures, the Council authorized the President to appoint a three-man committee to review and redraft the pertinent bylaws. This will be a subcommittee of the Committee on Professional Ethics. The members to be invited to serve are Chairman Malsberger, Archie E. Patterson, and Julius Kahn.

A preliminary report from the subcommittee has been requested for the November 1960 Council meeting, with a final report by the spring of 1961.

Communications

At the Council meeting held November 18, 1959 in San Francisco the members authorized the President "to appoint a committee to explore the possibility of improving communications between the executive office and the Sections, including the formation and expression of Society positions on broad policy questions."

Named to the committee were Donald E. Clark, chairman; F. T. Frederickson, Charles H. Lewis, Jr., William A. Parr, and Norman P. Worthington.

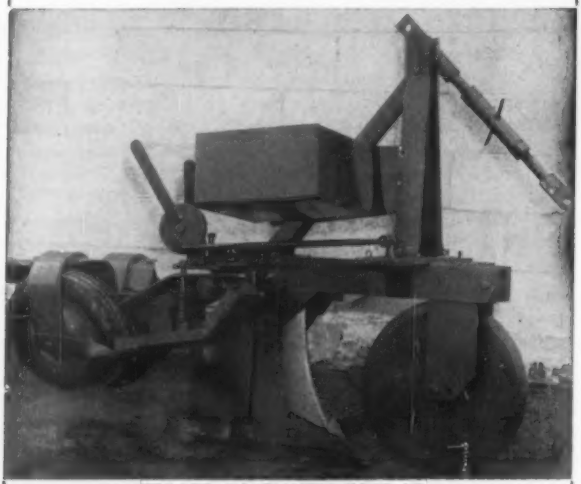
Information and opinions now being obtained by the committee will be discussed at the joint Council and Section delegates meeting on November 13, 1960 with a final report expected in the spring of 1961.

Tax Exemption for Nonprofit Conservation Organizations

Called to the attention of the Council was proposed legislation introduced in the House of Representatives "to amend the Internal Revenue Code of 1954 to provide tax exemption for nonprofit conservation organizations otherwise entitled thereto even though their activities may include the attempt to influence legislation." (H. R. 10211, February 4, 1960 by Hon. Philip J. Philbin of Massachusetts; refered to the Committee on Ways and Means.)

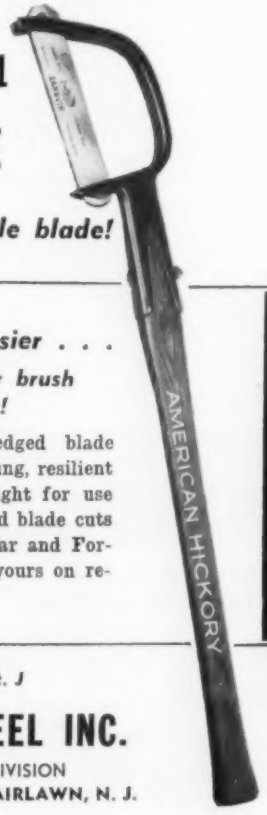
On a motion by Mr. Allen, seconded by Mr. Clark, the Council voted to take no action on the proposal to pro-

FIVE YEARS IN THE MAKING
24 different models of planters
NEW • IMPROVED • FIELD TESTED



THE WHITFIELD CONTOUR TRANSPLANTER
MODEL 54-BA
The Ideal Machine for Contour Planting and Underplanting
R. A. WHITFIELD MFG. CO. Gordon Rd., Rt. 2, Austell, Ga.

SANDVIK No. 1
BUSH AXE
With replaceable blade!



Safer, Faster, Easier . . .
than an Axe for brush or saplings!

The thin, flat, keen-edged blade slices easily through young, resilient stems. Balance and weight for use with one hand. Protected blade cuts closer to ground. Circular and Forester's Tool Catalog is yours on request.

Write Dept. J
Sandvik STEEL INC.
SAW & TOOL DIVISION
1702 NEVINS ROAD, FAIRLAWN, N. J.

vide tax exemption to nonprofit conservation organizations that may wish to influence legislation.

Society Policies Reviewed

On a motion by Mr. Hagenstein, seconded by Dr. Davis, the Council authorized the President to appoint a Council committee to review all Society policy statements as to their adequacy and to recommend changes where they are indicated and desirable. This action, in effect, is for the purpose of codifying the policy statements now in effect, even though some are obsolete.

President Connaughton named Prof. Heiberg as chairman of this committee, and suggested that he consult with former Council member J. S. Illick and with Executive Secretary Clepper.

U. S. Civil Service Policy on Forester Examination

Dr. R. J. Preston, chairman of the Committee on Civil Service, discussed U. S. Civil Service policies with respect to the examination for Forester and Forester (Range Management). On a motion by Mr. Hagenstein, seconded by Dr. Davis, the Council will prepare a resolution to the Civil Service Commission requesting that, as a requirement for admission to the junior professional examination (for Forester), the applicant shall have been graduated from an institution accredited for professional instruction in forestry.

In addition, on a motion by Dr. Preston, seconded by Mr. Hagenstein, the Council voted (Mr. Clark abstaining) to express its concern to the U. S. Forest Service over the use of the term "forester" for positions which do not require professional education and to urge the Forest Service to give consideration to finding some other title for those positions.

Affiliate Membership Bylaw 5, Class B

At the meeting of the Council held November 18, 1959 in San Francisco, the members present voted unanimously to repeal Bylaw 5, Class B, effective April 1, 1960. (For a detailed explanation of this action and the reasons therefore, readers are invited to refer to the JOURNAL OF FORESTRY for February 1960, pages 132 and 133.)

A new Bylaw 5, Class B has been adopted by the Council, on a motion by Mr. Allen, seconded by Mr. Hagenstein, effective immediately, as follows:

Bylaw 5. Class B. Persons who have had a combination of practical training and forestry education equalling at least six years shall be eligible. No person shall be eligible unless he shall have had at least 12 semester credits or 18 quarter credits of resident study in forestry subjects at a professional forestry school or ranger school. Each completed academic year of resident education (30 semester credits) at a professional forestry school or a ranger school may be considered as one calender year up to a maximum of four years. Qualifying forestry experience, which may be considered as meeting the practical training requirements, shall be obtained while the applicant is regularly engaged in growing forests, with attendant duties such as management or protection of forest areas, supervision of silvicultural requirements in logging, erosion control, or similar forestry activities; regularly engaged in related activities such as range, wildlife, or recreation management; or regularly engaged in those phases of utilization having a relation to the growing of forest crops.

Explanation. This new Bylaw 5, Class B means that the following kinds of applicants will be eligible for Affiliate Membership.

1. Foresters who have been graduated from nonaccredited schools that have less than five (or the equivalent of five) professional foresters on the teaching faculty, and who have obtained two years of qualifying experience in forestry following graduation.

2. Persons who have completed the forestry courses at a one-year ranger school and who have five years of subsequent qualifying forestry experience. Graduates of a two-year subprofessional curriculum in forestry will be eligible after having obtained four years of qualifying forestry experience.

3. Persons who have completed the junior year in a professional school of forestry and who have three years of subsequent qualifying forestry experience.

4. Persons not otherwise eligible for membership who have completed one year of a graduate (master's) program in forestry without graduation at a professional school of forestry and who have three years of subsequent qualifying forestry experience.

TM MODEL

Lowther Heavy duty tree planters insure deep penetration and straight root systems.

Our Sod Scalpers aid survival and growth.

Six distinctly different models available to cover all soil and terrain conditions.

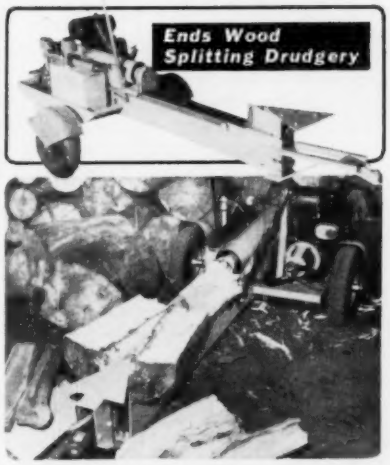
●

For details write

HARRY A. LOWTHER COMPANY

1671 DEARBORN STREET
AURORA, ILLINOIS

LICKITY LOG SPLITTER



Hydraulic power splits profits from waste wood • 7 HP trailer model • two speed • auto shift • auto stroke. Power "squats" to receive large diameter logs without "dead" lift—eighteen ton smooth hydraulic force cuts right through knots, 26" stroke handles up to 30" length, any diameter. Your name on a postal card will bring literature.

THE WACO AIRCRAFT CO., Dept. B, Troy, Ohio

Dealer Inquiries Invited

Proposed Amendment, Article III Affiliate Member Defined

Article III, Section 4 of the Constitution now reads as follows:

"Sec. 4. Affiliate Members shall be persons (1) who have had education in forestry but who do not qualify for Junior Membership; or (2) who have had six years or more of practical experience in the production of timber crops or management or protection of the forest resources of forest land, and who have demonstrated their ability in practical forest administration as evidenced by employment in positions of responsibility.

"Affiliate Members may be elected to Junior Membership on showing proof of eligibility."

On the recommendation of the Council Committee on Membership (B. E. Allen, chairman; W. C. Bramble, and W. D. Hagenstein), and on a motion by Mr. Allen, seconded by Mr. Garratt, the Council voted to submit the following proposed amendment of Article III, Section 4 to the voting membership by mail ballot.

Article III, Section 4. Affiliate Members shall be persons who have had education in forestry but insufficient to meet the requirements of the Junior Member grade. Affiliate Members may be elected to Junior Membership on showing proof of eligibility.

The Constitution may be amended by a two-thirds vote of the members voting, provided the proposed amendment has been submitted to all voting members at least four weeks in advance of the date set by the Council for counting the ballots. Publication of the proposed amendment herewith complies with the Constitutional provision for advance notice. Ballots will not be mailed until after the expiration of four weeks following receipt of this issue of the JOURNAL.

Explanation. If approved, this amendment will require that applicants for Affiliate Membership, who do not qualify as graduates under Class A and Class C, can still enter the Society provided that they have had the equivalent of one year of resident education in forestry subjects as a minimum. Persons who have had no education in forestry whatever may still enter through the Associate Member grade on due proof of eligibility.

Proposed Bylaw

As the Society is a nonprofit (not a stockholders) corporation the probability of legal proceedings against a Council member, officer, or employee is remote. But since the complexity of corporation regulations continues to increase, the possibility does exist of inadvertent or unintentional violation. Therefore, it would appear wise to protect Council members, officers, and employees against any penalty. To this end the following bylaw was proposed for adoption by the Council:

"Each Council member, officer, employee, and his heirs, executors, and administrators shall be indemnified by the Society of American Foresters against any costs and expenses, including counsel fees, reasonably incurred in connection with any civil, criminal, administrative, or other claim to which he might be made a party by reason of being a Council member, officer, or employee of the Society of American Foresters provided he is not adjudged derelict in the performance of his duties; and that he acted in good faith in what he considered to be the best interests of the Society and with no reasonable cause to believe the action was illegal."

On a motion by Mr. Allen, seconded by Dr. Davis, the foregoing proposed bylaw was referred to the Finance Committee for study and a recommendation.

FOR BIGGER PROFITS IN SMALL LOGS

GARRETT Tree Farmer

A smaller, more economical logging tractor!
Ideal for thinning, salvage, second growth, pulp!

Job records show sharply reduced skidding costs—fast production, low operating expense. Ground-gripping traction and easy maneuverability thru 4-wheel drive and steering, front axle oscillation. The TREE FARMER reduces road building needs and site disturbance. Write for spec sheet, performance data.

GARRETT ENUMCLAW CO.
800-J Stevenson Ave., Enumclaw, Wash.

PROCEEDINGS
(1959)
San Francisco, Calif. Meeting

A special volume containing all Division and General Session papers presented at the Society's Annual Meeting held in San Francisco, Calif., November 15-18, 1959.

Theme: "Forestry and People"
Postpaid $5 per copy
Send order with check.
SOCIETY OF AMERICAN FORESTERS
Mills Building, Washington 6, D. C.

Forestry Supplies and Equipment

THERE IS NO SUBSTITUTE FOR THE PERSONAL SERVICE THAT HAS BECOME THE TRADEMARK OF

The Ben Meadows Co.

Ben Meadows

When you buy, demand the best—the best in Service and the best in Equipment. You get both at The Ben Meadows Company—and at no extra cost.

Write today for Catalog No. 3

THE BEN MEADOWS COMPANY
315 Pharr Rd. N.E. Atlanta 5, Georgia

SCALERS! For Identification Marking

NEL-SPOT PAINT HAMMER and Log Marking Paint

Solve your problem of identifying wood by Specie, Type, Owner, Jobber, Mill or Cutting Season. Ideal for Inventory Control or locating brands.

Easy to identify — Simple to use — A light tap of the porous applicator leaves a Bright, Durable, Water Resistant Color Spot. (Cap prevents dry-in of applicator). Choice of many colors.

TRY IT — WRITE DEPT. JF

THE NELSON COMPANY
Iron Mountain, Michigan (Box 349)
Montgomery, Alabama (Box 1892)

Hospital-Medical Service

At the Council meeting of November 15, 1959 the executive secretary and business manager were instructed to study the feasibility of a hospital-medical service program for the Society's employees, and to report to the Finance Committee (Mr. Allen and Dr. Davis).

On the recommendation of the Finance Committee, the Council authorized the executive secretary to establish a hospital-medical service plan for the regularly paid employees of the Washington office with joint participation by the Society and the employees; provided that all employees elect to participate in the plan, such participation being a condition of its availability by the insuring agency.

Resolution of Thanks

A resolution drafted by Mr. Allen, and seconded by all Council members, voiced their unanimous appreciation to T. L. James & Company of Ruston, La., the host for this meeting; and to H. D. Burkhalter, James H. Kitchens, Jr., and Ben Rush of the Company's Forestry Division for their many kindnesses and courtesies.

Council's Column

Society Communications

Twenty years ago, the Society of American Foresters had 4,700 members; ten years ago 7,300. In 1960 we are shooting for a mark over 14,000. In 1970 membership should exceed 20,000. Twenty years ago, we had 19 Sections and no Chapters. In 1960, we have 22 Sections, 79 Chapters. Nine Sections have one or two Chapters or none. Six Sections have Chapters varying in number from six to fourteen. One Section with three Chapters, one for each state, has over 1,400 members.

The three primary objectives of the Society bear repeating periodically. They are:

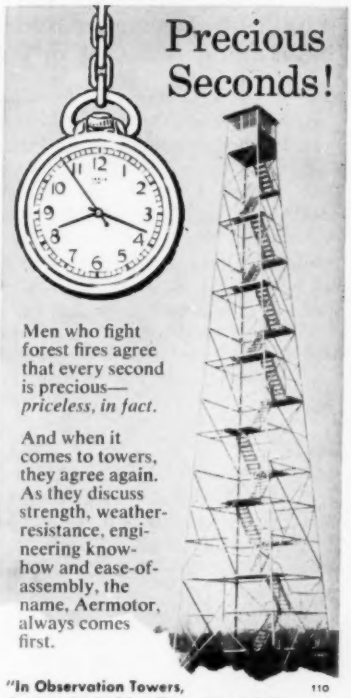
1. To represent, advance, and protect the interests and standards of the profession of forestry.

2. To provide a medium for exchange of professional thought.

3. To promote the science, practice, and standards of forestry in America. Good communications among the membership, among units of its organization, and between them, up and down and across, will be essential to its effective operations and to its growth if the Society is to continue to be dynamic; if it is to continue to carry out its objectives.

In January of this year for the purpose of possibly doing a Council's Column on this subject which, by the way, was brought up and discussed by several Section chairmen in their meeting with the Society Officers and Council members in San Francisco, I consulted by correspondence with chairmen of Sections and Chapters. I had several responses by April. Contained in these responses were expressions of concern, interest, and ideas, plus information on going organization and methods for Section and Chapter operations and communications. More or less simultaneously, your President appointed a committee to study communications within the Society. The committee consists of F. T. Frederickson, International Falls, Minn.; Charles H. Lewis, Jr., Alexandria, La.; William A. Parr, Bel Air, Md.; and Norman P. Worthington, Olympia, Wash.; with myself as committee chairman.

Precious Seconds!



Men who fight forest fires agree that every second is precious—*priceless, in fact.*

And when it comes to towers, they agree again. As they discuss strength, weather-resistance, engineering know-how and ease-of-assembly, the name, Aermotor, always comes first.

"In Observation Towers, the Standard of Excellence Since 1888" 110

AERMOTOR COMPANY
2500 W. Roosevelt Road • Chicago 8, Illinois

Apparently such unit is to be or could become a standing committee on "Intra-Society Communications." This is providing, of course, the committee does a job. Its members and chairmen need, will welcome, and will be open to fertile ideas. It needs and will welcome information from any and all sources in the Society that can be passed along to be of assistance to various units which desire ideas and benefits of experience of other units of the Society. Some expressions of such desires have already been indicated.

The study requested by the President is not intended to be a "quickie study." It will concern itself with factors and ideas on organization structures and machinery, and on media and methods which have potential for effective communications in a rapidly growing outfit. Cooperation from throughout the Society will be most helpful to doing a worthwhile job.

Memberships for the Society are important. Communications for and by the membership are essential to help ours grow and endure as a professional society worthy of its objectives.

DONALD E. CLARK

Gulf States Section Holds Annual Meeting in Louisiana

With an attendance of more than four hundred members, their ladies, and guests, the annual meeting of the Gulf States Section was held in Alexandria, La., May 12-13, 1960.

Chairman Charles H. Lewis, Jr., presided at the opening business meeting held in the Bentley Hotel. A report on membership and Section finances was given by A. B. Smith, secretary-treasurer. Henry Clepper, SAF executive secretary, discussed Society affairs.

Three special projects committees reported on their activities as a panel under the leadership of Edwin R. Ferguson. H. C. Cobb reported on the Section's forest tree seed certification program. Edward G. Roberts told about the Section's Committee on Natural Areas.

The following motion offered by John P. Wright was adopted: "The Gulf States Section of the Society of American Foresters reaffirms its previous motion expressing its concern with the possible effects of widespread chemical control programs upon the predators of forest insects, and recommends that the appropriate forest agencies and their forest entomologists be included in the planning and evaluation of research to determine the effects of the application of chemical insecticides to timbered lands or forest tree plantations."

New officers elected and installed were Richard C. Allen of Philadelphia, Miss., chairman; Marion A. Stephens, Jr., of Columbia, Miss., vice chairman; and J. Sidney McKnight of Stoneville, Miss., secretary-treasurer.

More than fifty companies and forestry organizations had outdoor exhibits of machinery and equipment at a site on the Kitsatchie National Forest near Alexandria. Included were International Paper Company's pulpwood harvester and Timberline Equipment Company's new "Buschmaster" forest management vehicle. Exhibits had been arranged by Ray Brandt.

An all-day program, arranged by George Cunningham, featured participants from the Merritt-Adams Training Institute of Shreveport, La., who demonstrated the fundamentals of good public relations.

At the Section's annual dinner, A. B. Smith was toastmaster. President Charles A. Connaughton gave a brief talk on the Society and the forestry profession.

An hilarious highlight of the evening was a "gridiron" type series of skits lampooning the foibles of individuals and programs in the three Section states. These were performed with vigor and enthusiasm by local members, under the direction of Ed Kerr.

The evening and the meeting closed with a dance in the Venetian Room of the Bentley Hotel.

Resolution

The Gulf States Section, Society of American Foresters, at its annual meeting May 12, 1960, is cognizant of the fact that the annual national meeting of the Society is scheduled on a rotation system and that commitments for the national meetings have already been made through 1964. The Gulf States Section desires to serve as host to the annual national meeting of the Society of American Foresters as early as possible after present commitments.

Therefore, be it resolved that the Gulf States Section does hereby officially and cordially extend an invitation to the parent Society to hold its annual national meeting in the Gulf States area in 1965 or at the earliest possible time before or after that date, and does hereby authorize and direct the chairman of the Section to forthwith implement this action in the form of an invitation to the Council with the specific site to be chosen later.

Frederick H. Cowles (1875-1960)

Frederick H. Cowles died on the night of April 12, 1960. He was born November 13, 1875, at New York City. Mr. Cowles, who resided in Santa Barbara County, Calif., for many years, was a member of the California State Board of Forestry from September 11, 1939, until December 31, 1943. He also acted as chairman during part of 1942 and until December 31, 1943.

Mr. Cowles took up residence in California in 1924 and became actively interested in the field of watershed protection in 1934 after the disastrous Matilija Fire which occurred in Santa Barbara County and destroyed over 200,000 acres of watershed. For many years during his residence in California he was con-

HAYNES Little Beaver Tree Girdler

For Practical-Economical Tree Girdling Use The

LITTLE BEAVER TREE GIRDLER—the machine that made tree girdling operations noticeable in the south. Get production in any tree girdling operation with this proven equipment.

The Complete One Man Girdling Operation

For Detail See Your Dealer or Write

HAYNES Mfg. Co. LIVINGSTON TEXAS

NEL-SPOT D-103 GUN

IMPROVED 5 Ways for Increased Efficiency

Shorter barrel for better balance, and easier trigger pull, are two easy-to-see improvements in this latest version of the famed Nel-Spot Tree Marking Gun. Try it, and you will appreciate these others:

3. Smaller piston and cylinder to use even less paint.
4. Two piece piston rod — time saver on repairs.
5. Larger nozzle sizes (.025 and .030) now optional.

And for top efficiency and economy, use this improved gun with Nelson's *non-settling money-saving* Tree Marking Paint.

ORDER FOR TRIAL—OR WRITE DEPT. JF

THE NELSON COMPANY
Iron Mountain, Michigan (Box 349)
Montgomery, Alabama (Box 1892)

sidered an ardent conservationist and a crusader for an adequate state forest fire protection organization. Initial impetus to the latter effort was attained during the trying period of early World War II when the present California Division of Forestry was implemented in accordance with a fire plan that had been prepared prior to and during the year 1940.

He became an Associate Member of the SAF in 1940.

Membership Applications and Advancements

Proposals for admission, advancement, and reinstatement received in the Society office during the month of May are listed below.

Action on the eligibility of those proposed for membership as listed below will be taken by the Council as of July 1960.

Communications from the voting members regarding the membership eligibility of these persons should be received in the Society office prior to that date.

Allegheny Section

Student Grade

PENNSYLVANIA STATE UNIVERSITY

Johnson, S. B.

WEST VIRGINIA UNIVERSITY

Earls, D. W. Hayhurst, C. K.

Junior Grade

Semago, W. T., Student, University of Missouri, Columbia, Mo. Pa. State, BSF, 1952, Univ. Mo., MS, 1960.

"Facts About Prisms"

1. Glass should be free of harmful aberrations. *Cruise-Master Prisms are.*
2. Size of prism should be large enough to permit use of gloves without danger of dropping prism. *Cruise-Master is the ideal size 40 by 40 M.M.*
3. Prisms should be drilled for neck cords. *Cruise-Master Prisms are.*
4. Leather cases are a must to protect fine lenses from scratches. *Another Cruise-Master first.*
5. Curved top on prisms, makes sighting point more uniform for all users. *Cruise-Master recognizes the importance of the curved top in their design.*
6. Accuracy, closer than 2 degrees of prism angle is a must as this gives approx. 4% error; accuracy closer than 1 degree of prism angle is equal to approx. 2% of error. Cruise-Master guarantees every Cruise-Master Prism to be exact or closer to within 1% of the rated Basil Area Factor. This is the key to accurate sampling. *Any Cruise-Master Prism found to exceed these limits will be replaced free of charge, upon return of prism.*
7. Every Cruise-Master Prism is etched with our Reg. T.M. & the BAF number. Cases are marked with the BAF number.
8. Special offers to schools of forestry.
9. Ground to even BAF for less error in calculating cruises.

CRUISE-MASTER PRISMS

597 Eureka Ave., Silverton, Oregon

The Heart of the Big Timber country

Member Grade

Bommer, R. H., Forester, M. C. Hoseworth Lbr. Co., Bedford, Pa. Pa. State, BSF, 1956 (Junior 1956).

Judd, H. P., Dist. Roadside Eng., Gibsonia, Pa. (Junior 1951).

Mitchell, W. C., Research Forester, Northeastern Forest Expt. Sta., Parsons, W. Va. Univ. Maine, BSF, 1956 (Junior 1956).

Yawney, H. W., Research Forester, Northeastern Forest Expt. Sta., Parsons, W. Va. Pa. State, BSF, 1955, MS, 1957 (Junior 1956).

Appalachian Section

Junior Grade

Kempf, L. W., Woodland Conservationist, Soil Cons. Service, Charlottesville, Va. (Reinstatement).

Central Rocky Mouuntain Section

Junior Grade

Orr, H. K., Research Forester, Rocky Mountain Forest & Range Expt. Sta., Rapid City, S. D. Colo. State, BSF, 1947, MF, 1948.

Smith, F. J., Forest Supv., USFS, Monte Vista, Colo. (Reinstatement).

Columbia River Section

Student Grade

OREGON STATE COLLEGE

Bussard, J. E. Schwietert, W.
Gannon, J. F. Stadelman, L. R.
Timberman, C. H.

Junior Grade

Apgar, W. L., Forester, Bur. of Indian Affairs, Warm Springs, Ore. N. Y. State, BSF, 1959.

Hales, F. J., Forester, Warren D. Hootman, Consulting Forester, Coos Bay, Ore. (Affiliate 1956).

Hamill, L., Instructor, Univ. of Oregon, Eugene, Ore. N. Y. State, BSF, 1949, MS, 1951.

Jensen, H. J., Forester, Willard Ranger Sta., Cook, Wash. Iowa State, BSF, 1942.

Knapp, W. H., Forester, USFS, Paisley, Ore. Pa. State, BSF, 1959.

Martin, M. A., Forest Eng., Moore Mill & Lbr. Co., Bandon, Ore. Univ. Wash., BSF, 1938.

Peterson, W. L., Asst. Unit Forester, Ore. State Board of Forestry, Tillamook, Ore. Univ. Maine, BSF, 1954.

Tracy, R. H., Dist. Ranger, USFS, John Day, Ore. (Reinstatement).

Member Grade

Minore, D., Resident Forester, N. W. Forest & Range Expt. Sta., Portland, Ore. (Junior 1953).

Affiliate Grade

Wilkins, J. R., Asst. Ranger, USDA, Prineville, Ore.

Gulf States Section

Junior Grade

Howell, E. M., Watershed Planner, USFS, Oxford, Miss. (Reinstatement).

Miller, E. G., Service Forester, La. Forestry Comm., Winnsboro, La. La. State, BSF, 1958.

Student Eligible for Automatic Advancement

LOUISIANA STATE UNIVERSITY

Ebarb, P. A.

Affiliate Grade

Higdon, J. D., Asst. Forester, Texas Forest Service, Lufkin, Texas.

Associate Grade

Webb, H. B., Mgr., Baldwin & Baldwin, Houston, Texas.

Inland Empire Section

Student Grade

UNIVERSITY OF IDAHO

Christy, D. A. Nelson, D. O.
Comstock, D. E. Ness, D. D.
Dickerson, F. O. Neweomb, R. L.
Ellison, L. N. Schultz, E. L.

Intermountain Section

Student Grade

UTAH STATE UNIVERSITY

Dexheimer, C. A.

Junior Grade

Krueger, O. F., Dist. Forester, Bur. of Land Mgmt., Kanab, Utah. Ore. State, BSF, 1958.

Kentucky-Tennessee Section

Member Grade

Cotterell, R. L., Forester, USFS, Cleveland, Tenn. Purdue Univ., BSF, 1955 (Junior 1955).

Fenton, B. W., Forester, USFS, Morehead, Ky. Utah State, BSF, 1954, Yale Univ., MF, 1955 (Junior 1954).

PRUNE TREES & PICK FRUIT
WASH WINDOWS FOUR STORIES HIGH
REMOVE LIGHT GLOBES 60 ft.

PHONE OR WRITE FOR
Free 24-Page Catalog
MFRS. OF A COMPLETE LINE OF
SWIMMING POOL EQUIPMENT
SOLD DIRECT TO YOU

MAdsn 6-9397

J. B. Sebrell
Dept. J, 301 S. San Pedro St., L. A. 13

New England Section

Student Grade

UNIVERSITY OF MAINE

Moore, J. P.

Junior Grade

Frost, S. W., Wood Supt., Eastern Pulp Wood Co., Princeton, Maine. Univ. Maine, BSF, 1947.

Walker, J. S., Forester, Maine Forest Service, Augusta, Maine. Univ. Maine, BSF, 1950.

Student Eligible for Automatic Advancement

UNIVERSITY OF MASSACHUSETTS

Richards, R. H.

Member Grade

Shaw, P. A., Staff Forester. USFS, Rutland, Vt., Univ. Maine, BSF, 1956 (Junior 1956).

New York Section

Junior Grade

Nevin, C. O., Forester, N. Y. State Cons. Dept., Canton, N. Y. N. Y. State, BSF, 1955.

Peterson, R. C., Student, N. Y. State College of Forestry, Syracuse, N. Y. Mich. College Mining & Tech., BSF, 1957.

Member Grade

Bassett, F. W., State Forester, N. Y. State Cons. Dept., Canton, N. Y. N. Y. State, BSF, 1956 (Junior 1956).

Northern California Section

Student Grade

UNIVERSITY OF CALIFORNIA

Ceragioli, J. S. Gregorich, S. W. (Reinstatement).

Junior Grade

Wallis, J. R., Research Forester, Pacific S. W. Forest & Range Expt. Sta., Berkeley, Calif. Ore. State, MF, 1955.

Northern Rocky Mountain Section

Student Grade

MONTANA STATE UNIVERSITY

Fairless, W. F.

Junior Grade

Olson, J. D., Company Forester, Yamhill Lbr. Co., White Sulphur Springs, Mont. Univ. Idaho, BSF, 1955 (Reinstatement).

Young, T. S., Resident Forester, Northern Pacific Railway Co., Seattle, Wash. (Reinstatement).

Member Grade

Arnold, R. W., Asst. State Forester, Office of State Forester, Missoula, Mont. Mont. State, BSF, 1949 (Junior 1956).

Mass, F. H., Forester, Deerlodge Nat'l. Forest, Butte, Mont. Univ. Mont., BSF, 1930 (Reinstatement).

Vars, H. T., Service Forester, Mont. State Forest Dept., Kalispell, Mont. Univ. Idaho, BSF, 1955 (Junior 1955).

Affiliate Grade

England, M. L., Forester, Flathead Agency, Dixon, Mont.

Ozark Section

Student Grade

UNIVERSITY OF MISSOURI

Kline, D. E. Spellman, D. L.

Junior Grade

Beene, J. T., Woodland Conservationist, Soil Cons. Service, Monticello, Ark. (Af52R59).

Member Grade

Wickstrom, E. B., Dist. Forester, Dierks Forests Inc., Broken Bow, Okla. Univ. Minn., BSF, 1951 (Junior 1956).

Affiliate Grade

Whitmer, D. A., Forester, International Paper Co., Camden, Ark.

Puget Sound Section

Student Grade

UNIVERSITY OF WASHINGTON

Ball, D. G. Herlocker, D. J.
Freese, R. G. Reed, J. E.

Member Grade

Maxwell, W. G., Dist. Ranger, USFS, Naches, Wash. (Junior 1953).

Southeastern Section

Junior Grade

Lorenzo, L. W., County Ranger, Ga. Forestry Comm., Valdosta, Ga. (Affiliate 1956).

McClure, M. W., Branch Asst., Fla. Forest Service, Tallahassee, Fla. (Reinstatement).

Member Grade

Booth, W. F., Forester, Union Bag-Camp Paper Corp., Savannah, Ga. Univ. Ga., BSF, 1956 (Junior 1956).

Laros, J. W., Forester, USFS, Talladega, Ala. Pa. State, BFS, 1940 (Junior 1956).

Parker, J. A., Dist. Mgr., Brunswick Pulp & Paper Co., Wayeross, Ga. Duke Univ., MF, 1951 (Junior 1956).

Schluter, E. A., Forester, Estes Forest Products Corp., Cantonment, Fla. (Reinstatement).

Williams, J. G., Area Forester, St. Marys Kraft Corp., Macclenny, Fla. Mich. State, MS, 1954 (Junior 1954).

Affiliate Grade

Craft, L. N., Circle Forester, St. Regis Paper Co., Pensacola, Fla.

Reynolds, W. J., Forester, USFS, Hillsboro, Ga.

Associate Grade

Wang, C. W., Assoc. Prof., Univ. of Fla., Gainesville, Fla.

Southern California Section

Member Grade

Corp, E. L., Dist, Ranger, USFS, Pasadena, Calif. (Junior 1953).

Southwestern Section

Junior Grade

Hart, J. S., Asst. Dist. Ranger, USDA, Flagstaff, Ariz. Colo. State, BSF, 1958.

Upper Mississippi Valley Section

Student Grade

IOWA STATE UNIVERSITY

Anderson, G. E.

UNIVERSITY OF MINNESOTA

Oettel, R. A. Sall, D. C.

Junior Grade

Hatcher, R. G., Dist. Forester, Iowa State Cons. Comm., Wapello, Iowa. Iowa State, BSF, 1949.

Washington Section

Junior Grade

Miller, J. E., Forester, Potomac Electric Power Co., Washington, D. C. (Reinstatement).

Wisconsin-Michigan Section

Junior Grade

Strong, R. G., Game Biologist, Mich. Cons. Dept., Sault Ste Marie, Mich. Univ. Mich., BSF, 1950.

Member Grade

Bowman, R. P., Forester, Kimberly-Clark of Mich., Michigamme, Mich. (Junior 1953).

Brown, H. L., Forester, USFS, Ironwood, Mich. (Reinstatement).

Enger, A. O., Asst. Dist. Forester, Mich. Dept. of Cons., Manistique, Mich. Mich. State, BSF, 1951, MS, 1956 (Junior 1954).

Affiliate Grade

Hurlbut, D. H., Mgmt. Forester, Nekoosa-Edwards Paper Co., Port Edwards, Wis.

No Section

Corresponding Grade

Sankhala, K. S., Divisional Forest Officer, Govt. of Rajasthan, Jaipur, India.

Singh, B., Divisional Forest Officer, Govt. of Rajasthan, Jaipur, India.

TREES FOR SALE

American Arborvitae, Balsam Fir, Engelmann Blue Spruce, White Pine, Scotch Pine, Norway Spruce, White Spruce, etc. Prices reasonable and trees are GUARANTEED TO LIVE. Write for FREE illustrated Folder.

WESTERN MAINE FOREST NURSERY COMPANY
Dept. JF Fryeburg, Maine

SILVA COMPASS

Easy, Precise, Fast to Use!

Recommended by foresters. Built-in mechanism to adjust for declination; sighting mirror; many other features. *Write for free literature and instructions.*

SILVA, INC. La Porte, Ind.

TREES FOR FOREST PLANTING

PINE•SPRUCE

We have grown Pine, Spruce and other conifers for 50 years.

KEENE FORESTRY ASSOCIATION
BOX 378, KEENE, NEW HAMPSHIRE

BAKED ENAMEL

METAL FORESTRY SIGNS

for WOODLAND BOUNDARY MARKERS—NO TRESPASSING & FIRE WARNING SIGNS—LOCATION MARKERS—CRUISER TAGS—etc., any size to your specifications. WRITE FOR QUOTATIONS ON ALL YOUR SIGN NEEDS. state size and quantity.

A. L. LIND COMPANY
5036 THOMAS AVENUE SOUTH
MINNEAPOLIS 10, MINNESOTA

FOREST SEEDS of CALIFORNIA

R. S. Adams & A. P. Baal

Professional Foresters

P.O. Box 561 — Davis, California

since 1952

Forestry News

E. W. Littlefield

Littlefield Succeeds Foss as N.Y. Lands and Forests Head

Commissioner H. G. Wilm of the New York Conservation Department has announced the July 1 retirement of William M. Foss from the position of assistant commissioner of Lands and Forests. He is succeeded by Edward W. Littlefield.

Mr. Foss has been head of the Division of Lands and Forests since 1952 and on retirement will have completed nearly 37 years with the Conservation Department.

Mr. Littlefield, who has been assistant director of the division since 1956, was previously in charge of the program of assistance to private forest landowners under the state's Forest Practice Act and cooperative Forest Management Act.

Both Foss and Littlefield entered the services of the Conservation Department in 1923.

Name New Head of Forestry at Iowa State

Appointment of Dr. Carl H. Stoltenberg as head of the department of forestry at Iowa State was announced May 13 by Iowa State University, following approval by the State Board of Regents.

He succeeds George B. Hartman who will retire under the age limitation ruling. Prof. Hartman will remain on the faculty in a teaching and research position.

Stoltenberg is a native of Monterey, Calif., who received the B.S. degree from the University of California in 1948, the M.F. degree from the same university in 1949, and the Ph.D. from the University of Minnesota in 1952. He goes to Iowa from the position of chief of the Division of Forest Economics Research, Northeastern Forest Experiment Station, U. S. Forest Service, Upper Darby, Pa. He has also been a member of the faculty at Minnesota, California, and at Duke University. His new appointment will be effective August 1.

Mississippi Passes Legislation to Aid Small Owners

The State of Mississippi has a new law sponsored by Governor Ross R. Barnett which is designed to help small landowners develop their timber resources, reports State Forester C. B. Marlin.

Plan now to attend the Sixtieth Anniversary meeting of the Society in Washington, D. C., November 13-16. See page 572.

Carl H. Stoltenberg

The act establishes a Forest Development Board to administer the law which provides for a lease agreement between the timber landowner and the Forestry Commission for the purpose of carrying out a timber improvement program.

In practice, each participating owner can, for a service charge of 5 percent, obtain up to $1,500 to use

FOR SALE
Slash, Loblolly, Longleaf and Shortleaf Pine Seed
In Wholesale Quantities
Treated with Rodent and Bird Repellent For Direct Seeding
For over ten years a dependable source for
Southern Pine Seed
SOUTHERN SEED COMPANY, INC.
Baldwin, Georgia

GRUBBING TONGS
With the Shox—Stox grubbing tongs you can clear brush and trees up to 10" Dia. from banks of streams, pastures and fence lines.
Removes growth cleanly — roots too. Trees can be pulled from any direction. Handles the power of all farm tractors. Tongs cannot slip, the harder you pull the tighter they grip.

No. 63C
Wt. 14 lbs. for Trees up to 6" diameter
Price Delivered $16.50
BARTLETT MFG. CO.
3015 E. Grand Blvd.
Detroit 2, Mich.

Consulting Foresters

Professional Services Offered by
Members of the Society of American Foresters

Land Surveyors *Consulting Forest Engineers*

BELANGER and BOURGET

86 MOUNTAIN HILL, QUEBEC,
P.Q., CANADA

Forest Surveys and Inventories. Establishing of boundary lines.

Forest Management and Logging plans. Locations for Wood industries.

FOREST MANAGEMENT

Topographic Mapping
Timber Stand Maps
Land Classification

Forest Development Studies
Forest Inventories
Forest Appraisals

Hammon, Jensen & Wallen

MAPPING AND FORESTRY SERVICES

660 HEGENBERGER ROAD OAKLAND 21, CALIFORNIA

General Photogrammetric and Forestry Consulting Services

KEITH CRANSTON, FORESTRY CONSULTANT
LELAND, MISSISSIPPI (HEADQUARTERS)

Professional services and nationwide loans on timberland, provided through *Connecticut General Life Insurance Co.*

Also supervision of estates; Management; Marketing; Appraisals; Forestry Personnel Placement with Industry.

POMEROY & McGOWIN

FOREST MANAGERS

Monticello, Arkansas Chapman, Alabama

TIMBERLAND MANAGEMENT. INVENTORY AND APPRAISAL
OVER 50 MILLION ACRES SINCE 1910

JAMES W. SEWALL COMPANY
FOREST ENGINEERS
OLD TOWN, MAINE

BRANCH: JAMES W. SEWALL CO. CANADA, LTD., FREDERICTON, NEW BRUNSWICK

in converting idle lands to productive forests. The landowner has the option of reimbursing said development costs and service charges on a monthly or annual basis, or he may be authorized by the Board to delay the reimbursement of said costs until income is received from the timber so leased. The lease will remain in effect for at least 10 years and not more than 20 years. During this time any income from the cutting of timber must be applied against the loan until it has been paid in full.

It is believed this act will stimulate timber production by small landowners who, as a group, lag behind in development of their forest resources.

The act is also an attempt to increase the flow of credit into forestry development work and to build up the raw material supply which will permit the expansion of existing wood plants and the development of new manufacturing facilities. Soil and water conservation, wildlife habitat, and reaction values will also be improved.

Wood Preserving Industry Reports Drop

The volume of wood treated by the wood preserving industry last year hit the lowest ebb in 25 years, the U.S. Department of Agriculture announced recently. The drop is attributed largely to the 31 percent decrease in the volume of crossties treated.

A total of 206.6 million cubic feet of wood was treated in 1959 according to a survey made by the USDA's Forest Service and the American Wood-Preservers' Association. This is 11 percent less than the 232.8 million cubic feet treated in 1958 and is the smallest amount since 1935 when companies estimated the volume at 179 million cubic feet.

The number of crossties treated dropped from 22,831,460 in 1958 to 15,642,277 in 1959. The volume of poles and crossarms treated increased 3 percent, but treatment of all other products such as piling, fence posts, lumbers, and timbers dropped.

This preliminary report is based on statistics from 327 of the 377 known wood treating plants in the country. Data are subject to revision in a final and more detailed report which will be published later.

The report, which also covers use of various preservatives, shows that use of creosote decreased 9 percent from 1958. The use of pentachlorophenol increased 20 percent; Tanalith use increased 18 percent; and Celcure increased 40 per-

cent. Use of all other preservatives decreased.

Northwest Observes Anniversary of Holocaust

Observance of the 50th anniversary of the great holocaust of 1910 began in the Northwest on Memorial Day at St. Maries, Idaho. Special services were held commemorating the 78 fire fighters who lost their lives in fires which burned three million acres of forests and several towns in Idaho, Montana, and Washington.

In addition to the commemoration at St. Maries, a special observance will be held later in the year at Wallace, Idaho. Several organizations will take part in the observance of the anniversary during the spring and summer, according to the Regional Office of the U.S. Forest Service in Missoula, Mont.

The great fires, which came to life on August 20 and raged for 48 hours, burned out the Montana towns of Taft, Haugan, and Deborgia, burned a third of Wallace, and threatened Newport, Wash.; Mullan, Idaho; Thompson Falls, Mont.; Elk City, Idaho; and Tuscor, Mont. Flames also threatened Havre and Bozeman, Mont., and later in the year destroyed the Minnesota towns of Baudette and Spooner. A total of 125 lives were lost in forest fires in 1910.

The theme of the summer-long anniversary observance will be progress in forest fire suppression and the need for continued vigilance in the use and protection of forest lands, Forest Service spokesmen said.

The St. Maries commemoration services were conducted jointly by the American Legion, Veterans of Foreign Wars and the U. S. Forest Service at the Firefighters Circle, Woodlawn Cemetery.

Portland, Oregon, Forestry Building Columns Named for Illustrious Conservationists

Plaques on the Douglas-fir columns in the Forestry Building at Portland, Ore., were recently dedicated for such illustrious conservationists as E. T. Allen; Horace J. Andrews; George M. Cornwall; David Douglas; William B. Greeley; George S. Long; Charles L. McNary; George W. Peavy; Gifford Pinchot; Theodore Roosevelt; George B. Sudworth; J. P. Weyerhaeuser; and Hugo Winkenwerder. The names were selected and approved by the Mayor's Gallery of Trees Committee. The building, called the "largest log cabin in the world," was built for the Lewis and Clark Centennial Exposition in 1905.

Brandborg Joins Wilderness Society Staff

Stewart M. Brandborg, assistant conservation director of the National Wildlife Federation, has resigned to accept a newly created position as special projects director of The Wilderness Society. He will work out of the Society's Washington office.

Brandborg was with the Federation for six years. In his new post with The Wilderness Society, he will assist in developing program and educational materials and will help promote the organization of state wilderness committees. He also will cooperate with other national conservation groups in the furtherance of mutual objectives.

A native of Idaho, Brandborg holds B.S. and M.S. degrees in wildlife management and forestry from the Universities of Montana and Idaho. Before moving to Washington in 1954, he worked with the U.S. Forest Service, Idaho and Montana state fish and game departments, and the Idaho Cooperative Wildlife Research Unit.

Schools

Southern Schools Hold Conclave

Eleven southern colleges and universities with forestry schools and departments were represented at the Third Annual Conclave of Southern Forestry Schools held at the Franklin D. Roosevelt State Park near Pine Mountain, Ga., April 30-May. 1. This year's conclave was sponsored by the Forestry Club, Department of Forestry, School of Agriculture, Auburn University.

Schools represented were: Arkansas A & M; Stephen F. Austin, Texas; North Carolina State; Clemson; University of Georgia; University of the

COST ESTIMATES—TAX APPRAISALS—CRUISING SURVEYS AND MANAGEMENT
INTERMOUNTAIN TIMBER SERVICE
4101 STATE ST.
PHONE 2-4300
THOMAS (TOM) C. CLIFTON

ADIRONDACK FORESTRY, INC.
David E. Strong Donald E. Peterson
Consultants
Estimates, Appraisals, Marketing
Management Plans, Tree Planting, Preservation
WILMINGTON, NEW YORK

PAUL T. WINSLOW
Consulting Forest Engineer
ESTIMATES—APPRAISALS—MANAGEMENT
STAATSBURGH-ON-HUDSON, N. Y.

ALBERT G. HALL
Forestry Relations Counsel
Consulting Forester
Member, Association of Consulting Foresters
810 18th St., N.W., Washington 6, D.C.

Consulting Forester Forest Surveyor
JOHN STOCK
Specializing in Adirondack Forest and Tax Problems
Box 311 Tupper Lake, N. Y.

ED. KNAPP COMPANY
Consulting Foresters
4435 Pio Nono Ave.
MACON, GEORGIA

TREE FARM MANAGEMENT SERVICE
1166-7th Avenue, West, Eugene, Oregon
Protection—Reforestation—Inventory
Utilization—Research
Verne D. Bronson, Chief forester, Phone 5-5371

GEORGE BANZHAF & COMPANY
622 North Water Street MILWAUKEE 2 BRoadway 6-2062
Consultants to the Wood Using Industries

R. B. SHANNON & ASSOCIATES
— Consulting Professional —
Engineers **Foresters**
Surveyors **Landscape Architects**
KITTANNING and INDIANA, PENNA.

WESTERN TIMBER SERVICES
California-Oregon-Washington
Robert E. Kleiner
Arcata, California
Arcata Hotel Bldg. — VA-2-1333

Porcius F. Crank, Jr.
Consulting Forester
Point Harbor North Carolina

FOREST PROPERTY
Estimates—Appraisals—Management
Prentiss & Carlisle Co., Inc.
107 Court Street Bangor, Maine

WILLIAM A. EASTMAN, JR.
Consulting Forester
Complete Professional Service
SEATTLE 1, WASHINGTON
410 J. GREEN BUILDING
'Phone MAin 4-2814

THOMAS F. SCHWEIGERT, R.F., R.L.S.
Consulting Forester
Land Surveyor
Penney Building, Petoskey, Michigan

JACK M. HALL
Consulting Forester
Appraisals - Selective Marking
Machine Tree Planting Service
MOULTRIE, GEORGIA

FRANK J. LEMIEUX
Forester
1015 WHITNEY BUILDING
NEW ORLEANS, LA.

South, Sewanee; Louisiana State University; Mississippi State University; University of Florida; Oklahoma University; and Auburn University. A total of 212 representatives of these schools and 13 guests registered.

Based on total points scored in 18 contests the three top schools were: Arkansas A & M, first place; University of Georgia, second; and North Carolina State College, third.

W. B. DeVall, forestry department head, School of Agriculture, Auburn University, presented prizes to individual winners and representatives of winning schools at a banquet on April 30.

Speaker at the banquet was Thomas Marshall, a graduate of LSU and representative of the Gulf State Paper Company, Demopolis, who spoke on "Futures in Forestry."

The fourth annual conclave will be held in Florida with the University of Florida as host school.

The conclave committee in charge of arrangements consisted of members of the Forestry Club with Dennis O'Gara as chairman.

University of Michigan Foresters Again Win Midwest Conclave

Students representing the School of Natural Resources of The University of Michigan won top honors at the 7th annual Midwest Forestry School Conclave held on April 30, at the Proud Lake State Recreation Camp near Pontiac, Mich. In recording their second straight victory, the Wolverine woodsmen scored 45 points in the various competitive events to match the total points made by the five other teams. Purdue was second with 18 followed by Michigan State University 9½, Michigan College of Mining and Technology 9, University of Minnesota 8, and Iowa State University ½.

During the day the contestants matched skills in tree identification, compass traverse, chain throwing, one and two man log sawing, log chopping, log throwing, log rolling with cant hooks, bait casting, match splitting, and tobacco spitting. In contrast to the 1959 field day when one Michigan man, Robert Martin, was largely responsible for his team's slim victory, the Ann Arbor school's 1960 win was a team effort with 13 different students contributing points. Robert Woelfel, huge team captain from Oshkosh, Wis., was high point man with 10. The outstanding performance of the day was recorded by Charles Spoon of Michigan who let out a 2½ chain trailer tape and then properly recoiled and threw it in 1 minute and 50 seconds.

The Michigan Foresters' Club was host to this year's gathering with senior Hoyt Wheeland in charge. The 1961 Conclave will be staged by the forestry students of Iowa State University.

Florida School of Forestry Celebrates 25th Anniversary

The University of Florida School of Forestry celebrated its 25th anniversary on May 13, 1960, with an honors banquet. The principal speaker was Paul M. Dunn, director of forestry, St. Regis Paper Co., New York.

At the banquet, scholarships totaling more than $8,000 were awarded to outstanding forestry students.

Harold S. Newins, director emeritus, who established the forestry department in 1935, was feted at the event. The department became a school in 1937 and graduated its first class in 1938. Since then the school has conferred 439 bachelor degrees and 38 master degrees. Dr. C. M. Kaufman, director of the school, in his progress report enumerated growth of the school's facilities including the Ranger School at Lake City.

The J. B. Adkins Memorial Scholarship was awarded to senior Roger Bollinger. As the outstanding forestry senior, Paul D. Wilder received the annual Newins-Ziegler Faculty Award. Donors of other scholarships and awards presented included the Junior Chamber of Commerce, Continental Woodlands Co., St. Regis Paper Co., Florida Wildlife Federation, and the SAF.

Avery Moves to Michigan State U.

T. E. (Gene) Avery, research forester at the Southeastern Forest Experiment Station, has resigned to ac-

SOIL SCIENTISTS **T. S. Coile, Inc.** FORESTERS
Forest Land Consultants
ROUTE 2, BOX 376, DURHAM, N. C. *Phones: 8-9240; 4902*
Land Appraisal Timber Inventories Soil-Site Surveys
Forest Management Planning Growth Prediction Research
"Forest Management Based on Soil Productivity"

Stevens Forestry Service, Inc.
Timber Estimates • Timber Marking • Timberland Management
If it's Trees or Timber, it's our Business
P. O. Box 1070 Phone 3-5068
EL DORADO, ARKANSAS

cept an assistant professorship in forest mensuration and photogrammetry at Michigan State University.

During his four years with the Forest Service, Dr. Avery has been doing research in aerial photo interpretation as applied to forest inventories. He has authored 15 technical articles and bulletins on aerial photography and forest mensuration during the past 5 years. His *Forester's Guide to Aerial Photo Interpretation,* published in 1957, has been reprinted three times and over 8,000 copies have been distributed.

A native of Atlanta, Ga., Avery served 3 years as a Navy aerial gunner during World War II. He has a Bachelor Degree in Forestry from the University of Georgia, an M.F. from Duke University, and a Ph. D. from the University of Minnesota. From 1950 to 1951 he worked as a management forester for Armstrong Cork Co., Macon, Ga., and from 1951 to 1955 was assistant professor of forestry at Arkansas A. & M. College, Monticello, Ark. He joined the Forest Service in 1956.

Medallion for McGinnies

Dr. William G. McGinnies, graduate and former faculty member of the University of Arizona, was recently awarded the university's 75th Anniversary Medallion of Merit. The presentation was made by President Richard A. Harvill at the conclusion of a 3-day Tree Growth Conference attended by 102 tree scientists. Dr. McGinnies is presently director of the Central States Forest Experiment Station.

Continental Can Company Forestry Scholarships Awarded

Continental Woodlands Division has just announced the awarding of Continental Can Company's annual forestry scholarships to the following: Milton E. Futch, Statesboro, Ga., and James E. Scoggins, Ashburn, Ga., who will attend the University of Georgia; James L. Hamrick III, Richmond, Va.; Donald B. Zobel, Apex, N. C.; and Jimmy Jacob, Castor, La. The scholarships, established to create a greater interest in the study of forestry, are for $1,000 per year for four years of study.

Dr. Lowe Studying at Kew Gardens During Summer

Dr. Josiah L. Lowe, research professor of forest botany at the State University College of Forestry at Syracuse University, is in Great Britain on a five-month National Science Foundation grant to continue his exploration of fungi causing rot in woods.

Dr. Lowe is recognized as a world authority on the genus Poria, an important group of wood-rotting fungi.

During the 20 weeks Dr. Lowe will be in the British Isles, he will be at the Royal Botanic Gardens, at Kew, England. There he will be working with the institution's fungous collections, checking through species known to occur in North America. This present project is a continuation of research he has been doing on the Polyporaceae of North America.

The results of Dr. Lowe's study will be published as part of a classification manual of fungi in North America on which he has been working for the past 15 years.

He received his Bachelor of Science from the State University College of Forestry at Syracuse University, and his Doctor of Philosophy degree from the University of Michigan, in 1927 and 1938, respectively.

He was appointed to the faculty of the State University College of Forestry at Syracuse University in 1933.

Dr. Lowe is scheduled to return to the United States at the beginning of the fall (1960) college term.

THE two Homelite Scholarship Award winners at Michigan State University are shown receiving their $250 checks at the Agricultural Honors Program on January 28, 1960. From left to right, Stanley Preshaw, junior, Department of Forest Products; Marvin Vander Kolk, junior, Department of Forestry; and Anthony Gruettner, district manager, Homelite Division of Textron, Inc., Detroit, Mich., who made the presentations. The scholarships are awarded annually to the outstanding junior students in the two Departments.

H. H. Biswell Awarded Fellowship and Scholarship

Harold H. Biswell, professor of forestry at the University of California, Berkeley, has been awarded a Guggenheim Fellowship and a Fulbright Scholarship for research and teaching in the field of range management.

Under the terms of the Guggenheim Fellowship, Biswell will study the historical role of fire in the development and structure of grass, brush, and forests in regions with Mediterranean climate.

His research will be conducted in southern France, Italy, Spain, Portugal, and Switzerland.

With the aid of the Fulbright Scholarship, he will teach a course in

JOHN G. GUTHRIE
Consulting Forester
BOX 517 WIGGINS, MISS.
PHONE WALNUT 8-4958

WILLIAM H. PRICE
FOREST MANAGEMENT
Specializing in
Timber Tax Problems
2626 W. Lynn—Seattle 99, Wash.
AT 3-7482

GION B. HOOKER
Consulting Forester
1072 ANZIO ST.
CRESCENT CITY, CALIFORNIA

EDWARD F. STEIGERWALDT
Consulting Forester
Tomahawk Wisconsin

DOMESTIC TROPICAL
WEST COAST
GREENACRES, INC.
FOREST CONSULTANTS—ENGINEERS—APPRAISERS
Complete Professional Services
6630 RAINIER AVE.
SEATTLE 18, WASH.
PArkway 5-7800
M. P. LAZARA
PERRY O. DONALDSON
KENNETH E. BEIL

range management and assist in establishing a department in this field at the University of Thessaloniki in Greece.

Biswell has written many scientific papers on range management, forage and grazing practices. He was the first editor of the *Journal of Range Management* and has been associate editor of both the JOURNAL OF FORESTRY and *Ecology*.

Penn to Hold Herbicides Symposium

A symposium dealing with Herbicides And Their Use In Forest Management will be held at The Pennsylvania State University on August 30-31, 1960. The two-day program is co-sponsored by the Department of Forest Management, The Pennsylvania State University, the Northeastern Forest Experiment Station, the Pennsylvania Department of Forests and Waters, and the New Jersey Department of Conservation and Economic Development. The program has been developed to furnish up-to-date information on chemical herbicides, their present day use, and future potential in forestry phases of land management.

Outstanding speakers will participate in sessions on I. Development, Present Status, and Characteristics of Herbicides; II. Legal Considerations; III. Forest Management Application —A. Wildlife Management, B. Silviculture.

Further information and registration particulars may be obtained from R. E. McDermott, program chairman, Department of Forest Management, The Pennsylvania State University, University Park, Pa.

Foundation Grant to N. Y. For Fertilization Studies

The National Science Foundation has awarded a $25,000 three-year grant to the State University College of Forestry at Syracuse University to support a new project on forest fertilization, it was recently announced.

Working on the research study will be Prof. Svend O. Heiberg, acting associate dean of resource management and graduate studies, and Dr. Albert L. Leaf, assistant professor of silviculture.

This is the first time that the college's resource management division and silviculture department have received a grant of this type, according to the announcement.

Private & Industrial

C. W. Richen Named President Industrial Forestry Assn.

C. W. Richen, Northwest timber operations manager for Crown Zellerbach Corp., Portland, Ore., was elected president of Industrial Forestry Association at its recent 26th Annual Meeting.

Other new officers elected were Werner Mayr, Mayr Bros. Logging Co., Hoquiam, Wash., vice president, and H. W. Freed, Longview Fibre Co., Longview, Wash., treasurer.

R. P. Conklin, Cascades Plywood Corp., Portland, was reelected secretary. W. D. Hagenstein and N. E. Bjorklund, Portland, were reelected executive vice president and assistant secretary respectively.

Retiring President H. O. Puhn emphasized the importance of the Association's Tree Farm Program to the region's economy. He reported total private land in the Association's tree farm movement to be more than 5.8 million acres. Other highlights reported included the 9.2 million tree crop of the Association's Greeley Nursery at Nisqually, Wash., which brought total production to date to more than 112 million trees and three established seed orchards as part of a tree improvement program.

H. E. Baggenstoss Elected President of the Forest Farmers Association

Herman E. Baggenstoss of Tracy City, Tenn., timberland owner and editor and publisher of the *Grundy County Herald*, was elected president of the Forest Farmers Association at the March meeting of the board of directors. He succeeds Harley Langdale, Jr., of Valdosta, Ga.

T. W. Earle of Savannah, Ga., vice president and general woodlands manager of Continental Can Company, was named vice president, succeeding John W. Squires of Jackson, Miss.

Both Mr. Baggenstoss and Mr. Earle have served on the board of directors of the association for a number of years.

The board also elected Arthur W. Nelson, Jr., of Hamilton, Ohio, a regional vice president, succeeding Walter J. Damtoft of Asheville, N. C. Mr. Nelson is general manager, timber products division, Champion Paper and Fibre Co.

Retiring president Langdale and vice president Squires were named directors at large, while Mr. Damtoft was named honorary director.

Elected to the board were R. V. Miles, Gulf States Paper Corp. Tuscaloosa, Ala., and Frank W. Bennett, Frank W. Bennett & Associates, Baton Rouge, La. Each was serving as director at large.

PLANTING TREES ?
Use a "FORESTER" or "CONSERVATOR" Planter
Complete information on request
UT&BCo
UTILITY TOOL & BODY CO.
Clintonville, Wis.

25 for $5. TREES ..
3 to 5 yr. healthy, selected trees, 8" to 16" tall. 5 each of: Colorado Blue Spruce — Norway Spruce — Austrian Pine — Scotch Pine — Douglas Fir.
Postpaid at planting time
Write for Free Evergreen Catalog
MUSSER FORESTS Box 26-C Indiana, Pa.

THE FECHHEIMER BROS. CO.
UNIFORMS FOR OVER 80 YEARS
U. S. FOREST SERVICE—STATE AGENCIES
MISC. OUTDOOR EMPLOYEES
Complete Price List on Request
CINCINNATI 2, OHIO

PACIFIC WEATHER SERVICE
WEATHER: Forecasts—Warnings—Modification.
Fire Danger Rating—Instruments
J. B. "Ben" Melin, Meteorologist
1222 N.E. 117th Ave., Portland 20, Oregon
AL. 2-5410

EVERGREEN SEEDLINGS AND TRANSPLANTS
Growers of Pine, Spruce, Fir, Hemlock, etc.
FREE WHOLESALE PRICE LIST
SUNCREST NURSERIES
BOX 305-G, HOMER CITY, PENNA.

Infringers and imitators warned.
Best Chrome Durable Strong, Steel
3 Patents. Best material. Sold by the thousands.

THE RENOWNED
CHARLES H. RICH
"Forest Fire Fighting Tool"
Write for Prices and Descriptions
C. H. RICH FOREST FIRE TOOL CO.
218 W. Bald Eagle St.
Lock Haven, Pa.

BETTER SURVIVAL,
BETTER GROWTH
WITH
ROOTSPRED
TREE PLANTERS

ROOTSPRED "Lake States". Scalper reduces competition 15" each side of planted tree.

- All our planters cultivate soil to 14" below surface—several inches below bottom trench. Promotes early root growth at deeper levels. Coulters to 28" diam. available.
- Scalper removed or installed in a minute. Non-clogging.
- Rootspred has an economical, heavy-duty, lift-type planter at only $275.
- Satisfaction guaranteed on all our products.
- We have sharp edge bedlifters and root pruners. Cut instead of mangle.

For specifications, prices, photos, write:

ROOTSPRED
St. Petersburg, Pennsylvania

R. E. Haynes of New Bern, N. C., was appointed director at large. He is with the division management staff, West Virginia Pulp and Paper Co.

J. W. Church Appointed Branch Manager

James W. Church has been appointed manager of Weyerhaeuser Company's Vail-McDonald branch, it was recently announced by Philip H. Hogan, logging manager of the firm's lumber and plywood division.

Church is reported to be the first career forester to assume the top administrative post in any Weyerhaeuser branch operation. He succeeds the late Harold L. Reichel.

In April, Church was named assistant manager of the branch. He had served as logging superintendent since 1957, and was branch forester from 1952.

His career with Weyerhaeuser Company began at the Snoqualmie Falls, Wash., branch in 1940, where he was employed as a scaler's assistant. After Army service in World War II, he became branch forester there.

Church is a graduate of the University of Washington School of Forestry.

Crown Zellerbach Foresters Promoted

Crown Zellerbach Corporation has announced the appointment of G. H. Harrington as log buyer and seller for the company's Tillamook division.

For the last six years, Harrington has been resident forester at the company's Tahkenitch Tree Farm near Gardiner, Ore.

D. G. Campell, forest engineer at Crown Zellerbach's Olympic Tree Farm near Port Townsend, Wash., will succeed Harrington at the Tahkenitch post.

A native of Oregon City, Ore., Harrington joined Crown Zellerbach as a woods scaler at its Clackamas, Ore. division in 1947. A graduate of the Oregon State College School of Forestry, he served with the U.S. Army from 1940 through 1946.

Campbell, a graduate of Montana State University School of Forestry, started with Crown Zellerbach at its Columbia, Ore. division as a forester in 1951.

Duane B. Clocksin has been appointed to the post of forest engineer for the Olympic Tree Farm, succeeding Campbell.

Clocksin, a University of Washington College of Forestry graduate, joined Crown Zellerbach as a forester at the Port Townsend division in 1952.

Appointed Forester for Pocahontas Land Corporation

Robert E. Snelling, SAF member, was appointed forester for Pocahontas Land Corporation with headquarters in Bluefield, W. Va., on May 1, to fill the vacancy created by the death of D. B. Bonebrake last December.

Prior to this appointment, Snelling was for several years forester for Pocahontas Fuel Company, Division of Consolidation Coal Company, Pocahontas, Va., and district forester in the Forestry Division of the West Virginia Conservation Commission.

Newland Reappointed by Kentucky

Harrod B. Newland, director of forestry, has been rehired by the State of Kentucky to promote the manufacture of wood products, it was announced recently by Lt. Governor Wilson W. Wyatt and Economic Development Commissioner E. Bruce Kennedy.

Wyatt and Kennedy said Newland will work in economic development supplementing the program being conducted by the Division of Forestry in the Conservation Department.

Newland, a native of Louisville, graduated in forestry from Iowa State College. He was assistant director of forestry in Kentucky from 1935 to 1944, then served as state forester for 13 years.

BAND, NUMBER, LETTER, WRITE OR SPOT TREES OR LOGS EASILY

Nelson
AERO-SPOT

The only Aerosol can with real tree marking paint. Long lasting durable paint for CFI work, boundry, seed tree and other special marking. Choice of nozzels and colors.

Try it! Order today or write for further information

THE NELSON COMPANY
Iron Mountain, Michigan (Box 349)
Montgomery, Alabama (Box 1892)

Mays Heads USFS Civil Defense Program

Larry K. Mays, chief of the Division of Operation for the Southern Region of the U. S. Forest Service, Atlanta, Ga., since 1956, on May 2 became coordinator of the nationwide Civil Defense program of the Forest Service with headquarters in Washington, D.C.

Prior to the assignment in Atlanta, Mays had many varied assignments in the Pacific Northwest Region at Portland, Ore. He served in positions including fire control chief and assistant regional forester in charge of operation.

A native of Colorado, Mays received his forestry education at Washington and Oregon State Colleges. His first permanent appointment with the Forest Service was in 1931 on the Gifford Pinchot National Forest. Since 1937, he has held positions on the Umatilla

Index to Advertisers

	Page
Adirondack Forestry, Inc.	587
Aermotor Co.	581
Banzhaf, George & Co.	587
Bartlett Mfg. Co.	585
Belanger & Bourget	586
Caterpillar Tractor Co.	552, 553
Coile, T. S. Inc.	588
Crank, Porcius F. Jr.	588
Cranston, Keith	586
Cruise-Master Prisms	583
Eastman, Wm. A. Jr.	588
Fechheimer Bros. Co.	590
Forest Seeds of California	584
Forestry Suppliers, Inc.	576
Garrett Enumelaw Co.	580
Greenacres, Inc.	589
Guthrie, John G.	589
Hall, Albert G.	587
Hall, Jack M.	588
Hammon, Jensen & Wallen	586
Haynes Mfg. Co.	582
Homelite Corporation	4th Cover
Hooker, Gion B.	589
Intermountain Timber Service	587
Keene Forestry Assn.	584
Knapp, Ed. Co.	587
Lemieux, Frank J.	588
Lind, A. L. Co.	584
Lowther, Harry A. Co.	579
Meadows, Ben Co.	580
Mora Chemical Co.	577
Motorola	3rd Cover
Musser Forests, Inc.	590
National Agric. Supply Co.	577
Nelson Co.	581, 582, 591
Pacific Weather Service	590
Panama Pump Co.	514
Pomeroy & McGowin	586
Prentiss & Carlisle	588
Price, William H.	589
Rich, C. H. Forest Fire Tool Co.	590
Rootspred Tree Planter	591
Sandvik Steel Co.	578
Schweigert, Thomas F.	588
Sebrell, J. B. Co.	583
Sewall, James W. Co.	586
Shannon, R. B. & Assoc.	587
Silva, Inc.	584
Smith, D. B. & Co.	2nd Cover
Southern Seed Co.	585
Steigerwaldt, Edward F.	589
Stevens Forestry Service, Inc.	588
Stock, John W.	587
Sunerest Evergreen Nurseries	590
Tree Farm Mgmt. Service	587
Utility Tool & Body Co.	590
Waco Aircraft Co.	579
Western Fire Equipment Co.	514
Western Maine Forest Nursery	584
Western Timber Services	588
Whitfield, R. A. Mfg. Co.	578
Winslow, Paul T.	587

Forest where he headed fire control activities, on the Deschutes Forest as assistant forest supervisor, and on the Fremont National Forest as forest supervisor.

In 1954, at the request of the Department of Agriculture, he was appointed to the Field Services Review Team which studied effectiveness of the Department's field services in the South and West.

Mays has been a member of review teams on three disaster forest fires where lives had been lost, and served on a force which studied large forest fires and prescribed a program of safety for use in wild fire suppression.

N. T. Mirov Receives Rockefeller Grant

Dr. Nicholas T. Mirov, plant physiologist of the Pacific Southwest Forest and Range Experiment Station of the U. S. Forest Service and lecturer at the University of California, Berkeley, is the recipient of a grant from the Rockefeller Foundation given for continuation of his studies of pines.

Dr. Mirov expects, early in 1961, to visit pine regions of Indonesia, Viet Nam, Thailand, Burma, Philippine Republic, Korea, Okinawa, and Japan.

Entomologist and Utilization Research Specialists Appointed

Dr. Clarence G. Thompson, head of the Agricultural Research Service's Laboratory of Insect Pathology at Beltsville, Md., has been named to the staff of the Pacific Northwest Forest and Range Experiment Station. He will direct a program of basic studies in diseases of forest insects, it has been announced by R. W. Cowlin, director of the Forest Service experiment station. Laboratory and office space will be provided in Cordley Hall by Oregon State College.

Harold E. Worth and Douglas L. Hunt have been appointed to fill vacancies on the forest utilization research staff of the station.

Worth was transferred from the Bureau of Ships, Department of the Navy, Washington, D. C., where he has been employed as a wood technologist since 1952. He was presented with a Navy Superior Accomplishment Award in 1958.

Hunt goes to the station from the Western Pine Association Research Laboratory in Portland, Ore., where he has been doing research on waste utilization and products development since 1953.

Gaines Heads Ponderosa Quality Studies

Edward M. Gaines has been assigned to the U.S. Forest Service experiment station in Berkeley to take charge of ponderosa pine timber quality studies as part of a national project studying log and tree grades, it has been announced by Dr. Keith Arnold, Director of the Pacific Southwest Forest and Range Experiment Station. Gaines transferred to Berkeley from the Rocky Mountain Station where he was a research center leader at Flagstaff, Ariz.

A forestry graduate of Washington State College, Gaines has done graduate work at the University of California and has been a member of the Forest Service since 1935. Since 1946 he has conducted research work at Crossett, Ark., and Brewton, Ala., before his assignment at Flagstaff.

Forestry Employment

S.A.F. members are privileged to insert one 60-word advertisement in this column without charge. Forest industries desiring to employ foresters may insert advertisements at the rate of $4 per column inch. Copy must be received by the end of this month for an advertisement to appear in the issue after next.

Obviously the Society cannot assume responsibility beyond making it possible for prospective employee and employer to enter into negotiations.

Position Available

Lassen Junior College has announced a vacancy for an Instructor of Forestry to be filled by September 1. Starting salary range for a man with masters degree from $5300-$6100 for academic year (9 months). Experience in general forestry work with emphasis on aerial photography is desired.
Address application to Director, Lassen Junior College, Susanville, Calif.

Positions Wanted

Forester, B.S.F., 1951, University of California. Age 30, married, no children, veteran. 6 years with U. S. Forest Service (Southeast and Western United States) in TSI, logging Road location, right-of-way negotiations, timber sale layout and administration, and general land use administration. 1 year experience with Army Map Service in topographic surveys. Desire position in private industry with opportunity for advancement.
Box A, Journal of Forestry, Mills Building, Washington 6, D. C.

Wood technologist with forestry background. B.S. Forest Products Utilization, 1959; M.W.T. (Wood Technology) September, 1960, Univ. of Michigan. Age 25, single, veteran. Experience includes wood-drying studies and thesis work primarily upon the effects of moisture and heat on stresses in wood. Desires position in basic wood drying research. Will consider wood quality—tree growth studies, or wood quality — genetics studies provided qualities, other than just specific gravity are considered.
Box B, Journal of Forestry, Mills Building, Washington 6, D. C.

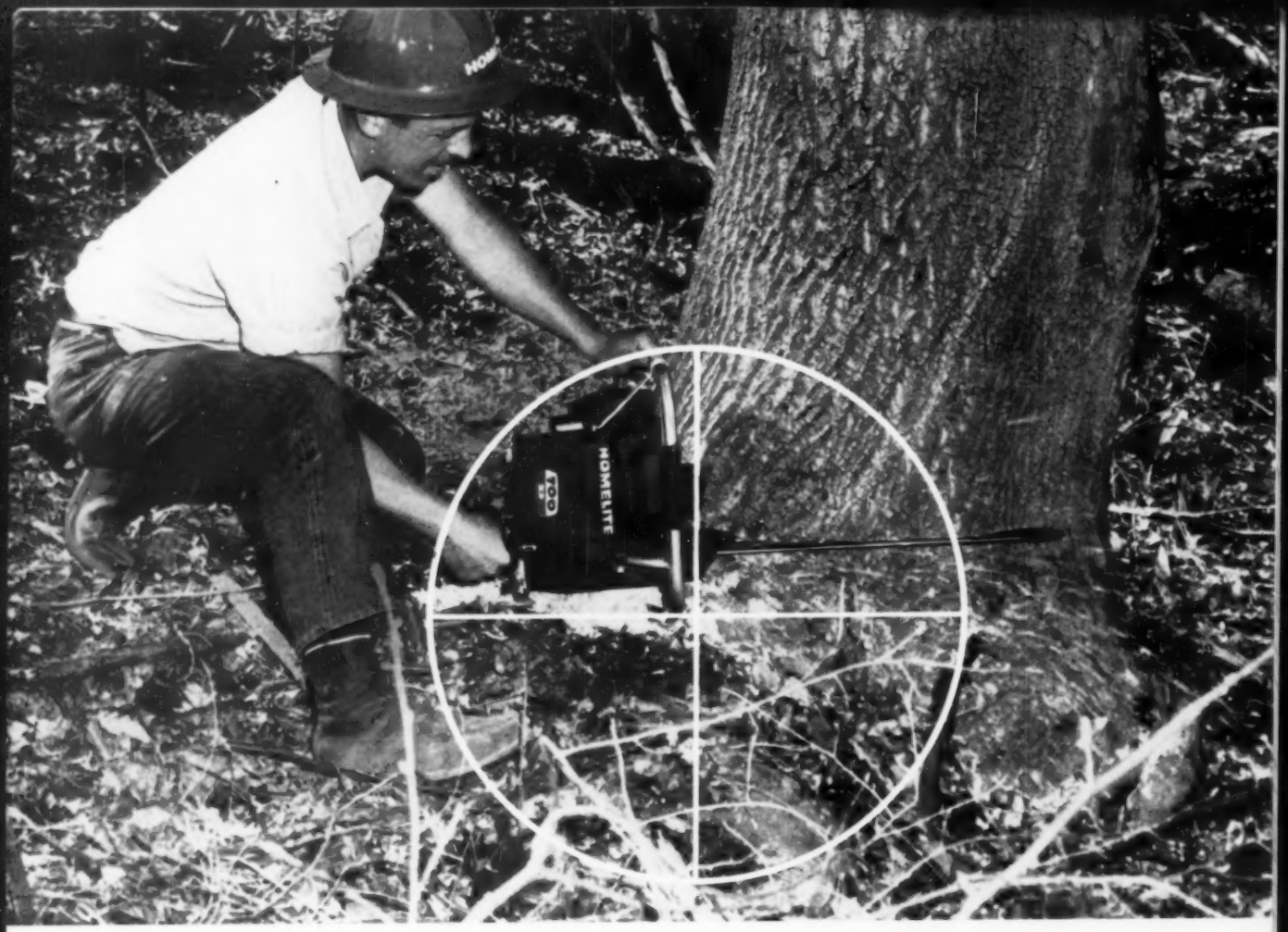
Saving minutes with portable radio means saving lives and timber! When your forces are stretched thin . . . when every minute counts—instant 2-way radio contact can multiply the effectiveness of every man and machine on the fire line.

And in coordinating everyday operations, the Motorola "Handie-Talkie" radio proves so versatile and reliable that 8 out of every 10 portable 2-way radios are Motorola! And for good reasons—they are the lightest, toughest and most economical-to-operate units made. Motorola offers 74 models with standard or "Private-Line" operation, dry cell or rechargeable nickel-cadmium battery supply, speaker-microphone or telephone-type handset options—and up to 8 watts RF output.

Important, too, is the fact that each model is designed and produced by Motorola 2-way radio experts—backed by almost 3 decades of communications experience. Units are job-matched to your needs by a factory-employed Motorola Sales Engineer. And you can depend on nearby Motorola factory-supervised service to keep your equipment on-the-job. Write for full facts today.

MOTOROLA
Handie-Talkie®
RADIOPHONE

Handie-Talkie, Private-Line are registered trademarks of Motorola Inc.
Motorola Communications & Electronics, Inc., 4501 Augusta Blvd., Chicago 51, Ill. A Subsidiary of Motorola Inc.



SET YOUR SIGHTS ON MORE POWER WITH

NEW HOMELITE 700 D

You'll be shooting for more power and profit when you set your sights on this new Homelite 700-D direct drive chain saw.

You get power to fell trees up to 5 feet in diameter . . . speed to cut 18" softwood in 12 seconds, 8" hardwood in 4 seconds.

New, important features make possible this new kind of cutting ease and day-in-day-out dependability:

More Power • larger piston and cylinder have 2 3/16" bore 5.64 cubic inch displacement • larger intake passages and port areas give freer flow of fuel charge.

Better Performance • stronger, tougher, powdered-steel clutch spider transfers more engine power to chain • longer chain and bar life because new long-flange guide plates feed chain smoothly into bar groove. Eliminate chatter. Cut replacement costs • 10 times longer operation without cleaning because new sealing cap on ball drive assembly keeps dirt, sawdust out of sprockets • Better filtering and sealing against snow, dirt, sawdust with new "Plastisol" ends on big air filter.

Set your sights on the power and performance you get with the new Homelite 700-D, backed by all the other famous Homelite features of power and dependability. Ask your dealer for a free demonstration of this newest direct drive member of the full line of Homelite chain saws.

Find Your Homelite Dealer In The "Yellow Pages"

As Low as $4.55 Weekly after small down payment

• direct drive • two attachments — brushcutter and 16" plunge cut bow • new power keeps chain running at full speed in hardest wood, biggest trees

HOMELITE A DIVISION OF TEXTRON INC.

4107 Riverdale Avenue, Port Chester, New York

In Canada — Terry Machinery Co., Ltd.

THINK FIRST OF QUALITY . . . THINK FIRST OF HOMELITE